WAVETEK

LANTEK™ PRO / LANTEK PRO XL

100 MHz LAN Cable Testers with Dual NEXT™

User's Guide

This document contains information proprietary to Wavetek Corporation. The information in this document is not to be used or duplicated in any manner without prior written approval from Wavetek Corporation.

LANTEK, Dual NEXT, and **Cable Expert** are trademarks of Wavetek Corporation.

WAVETEK and the **WAVETEK logo** are registered trademarks of Wavetek Corporation.

All other product names mentioned in this book are trademarked or copyrighted by their respective manufacturers.

Wavetek
Instruments and Datacommunications Division
9045 Balboa Avenue
San Diego, CA 92123
(800) 854-2708
(619) 279-2200

Manual Part No. 1006-00-0791 Rev B
©Wavetek Corporation 1995 *Printed in USA* *12/95*

SAFETY PRECAUTIONS

Page

SAFETY PRECAUCIONS i

SICHERHEITSMAßNAHMEN iv

MESURES DE SECURITE vii

PRECAUCIONES DE SEGURIDAD x

SAFETY PRECAUTIONS

Read all precautions before handling battery packs or using the Dual Bay Battery Charger

HANDLE BATTERY PACKS WITH CARE

CAUTION - All nickel-cadmium battery packs, regardless of their indicated charge state, are capable of producing electrical currents sufficient to cause personal injury and/ or property damage.
Wavetek has tried to provide the maximum protection possible by installing an automatic reset fuse in every battery pack to help stop high current discharges as quickly as possible. However, this fuse may not completely protect against a momentary arc, which can result if the battery pack's electrical contacts are shorted. The following are BP-PRO battery pack handling precautions that must be closely followed to avoid risk of injury.

DO NOT dispose of Ni-Cd battery packs in a fire or with regular trash. Ni-Cd batteries may explode if exposed to open flame, create hazardous waste and contaminate ground water sources if disposed of in land fills.
DO return the expended battery packs to your local distributor for recycling or disposal in accordance with local laws and regulations. Please refer to the recycling information on the following pages. The following are BP-PRO battery pack handling precautions:

- When a battery pack is not installed in the handset or the charger, it should be kept in a clean dry non-conductive package. Two plastic protector boots are included with the LANTEK PRO/PRO XL for this purpose.
- Keep conductive materials away from the battery contacts at all times.
- Keep the contact sides of the battery packs away from each other at all times.
- Use only Wavetek's Dual Bay Battery Charger to charge the BP-PRO battery packs. Charging with other chargers or in any other manner may cause the packs to explode.
- Always install, remove, store and charge the battery packs in a non-explosive atmosphere.
- Use and store battery packs in locations that do not exceed 50 Celsius.
- Do not allow children or persons unfamiliar with the precautionary instructions in this manual to handle or recharge the battery packs.
- Leave the sealed battery pack case intact. There are no user-serviceable parts inside the case and the batteries in the case are not replaceable.

DUAL BAY BATTERY CHARGER OPERATING PRECAUTIONS

Read and follow all precautions prior to connecting AC outlet power to avoid risk of electrical shock and/or equipment damage.

Check the AC voltage setting before use. Be sure the green arrow indicator on the IEC 320 plug panel is pointing toward the correct voltage for your geographic area.

Protect the charger from exposure to rain or other sources of moisture and immediately discontinue use of the charger if exposure has occurred.

Only use the charger and its AC power cord if both are free of damage.

Be sure the power cord supplied with your charger is the correct type for your geographic area of operation. If it is not correct, see your distributor for a correct cord prior to connecting the charger to an AC power outlet.

Keep the battery wells free of conductive materials and other objects. Unplug the charger before attempting to remove any objects or debris from the wells.

Charge only Wavetek's BP-PRO batteries with this charger. Other batteries may explode causing personal injury, property damage or damage to the charger.

The chargers' case must remain sealed. There are no user-serviceable parts inside.

Fuses must only be replaced with fuses having the specified voltage and ampere rating. Wavetek recommends using the type of fuses listed on the charger's label (see bottom of charger) and as indicated in this manual.

To prevent overheating, ensure that the charger's ventilation louvers are unobstructed and that there is sufficient air flow for cooling to keep environmental conditions within the specified operating temperature range listed in this manual.

The IEC-320 installed jack has designed safety features intended to protect against personal injury and to protect the equipment. Do not attempt to defeat these features or open the IEC-320 jack while connected to an AC power outlet. See Chapter 1 of this manual for instructions covering the IEC-320 installed jack and how to change the voltage setting and fuses.

If at any time the charger or its power cord is exposed to moisture, damaged, or not operating properly the charger should be returned to your local distributor for repair by an authorized Wavetek representative or disposed of properly. Refer to Chapter 7 of this manual, Customer Service and Warranty, for more information.

STATEMENT OF LIABILITY

Wavetek does NOT assume any liability for death, injury or damage to equipment or property resulting from the use of this charger in a manner inconsistent with the use for which it was intended. Wavetek Corporation will not be liable for consequences that may result from tampering with the battery packs or charger or consequences resulting from their use thereafter.

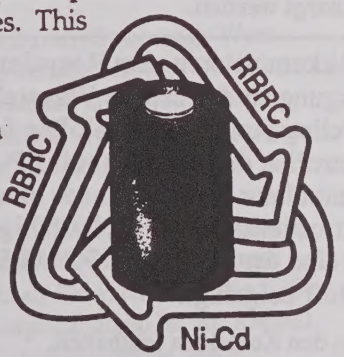
RECYCLE ALL Ni-Cd BATTERY PACKS

Please protect the environment. Rechargeable nickel-cadmium battery packs provide the most efficient long-life source of power for portable electronic equipment. Their recharg· capability makes them environmentally friendlier than regular carbon lead batteries by reducing the volume of lead and chemical waste that requires disposal.

When expended, the packs should be properly disposed of in accordance with local environmental regulations concerning nickel-cadmium (Ni-Cd) batteries.

> **DO NOT** dispose of Ni-Cd battery packs in a fire or with regular trash. Ni-Cd batteries may explode if exposed to open flame, create hazardous waste and contaminate ground water sources if disposed of in land fills.
> **DO return** the expended battery packs to your local distributor for recycling or disposal in accordance with local laws and regulations.

The new RBRC recycling symbol shown above and on all BP-PRO battery packs indicates that Wavetek has paid the licensing fees for participation in a national program to recycle all Ni-Cd batteries. This national program was just recently launched and Wavetek is one of the first companies to actually participate in this voluntary environmental protection effort. The RBRC symbol battery packs should be returned to your distributor or any RBRC collection center for recycling. The cost for shipping from a participating RBRC collection center to a recycling facility and recycling these battery packs within the United States has already been paid by Wavetek.



If you live or work outside the United States and have a LANTEK PRO/PRO XL with a depleted battery pack, please contact any Wavetek authorized local distributor for information on recycling programs available in your area of the world.

THANKS FOR HELPING TO PROTECT THE ENVIRONMENT

If you have any questions concerning these precautions, the operating instructions, or any other concerns about the safe operation of the BP-PRO battery packs or the Dual Bay Battery Charger, please contact a Wavetek representative at one of the offices listed in Chapter 7 of this manual, Customer Service and Warranty.

SICHERHEITSMAßNAHMEN

Vor der Verwendung von Akkumulatoren oder dem Doppelfach-Ladegerät alle Sicherheitsmaßnahmen sorgfältig lesen

MIT AKKUMULATOREN VORSICHTIG UMGEHEN

ACHTUNG! Jeder Nickel-Cadmium-Akkumulator kann unabhängig vom angezeigten Ladezustand einen elektrischen Strom erzeugen, der hoch genug ist, um Verletzungen oder Sachschaden zu verursachen.

Wavetek hat sich bemüht, den maximalen Schutz zu bieten, indem jeder Akkumulator einen Sicherungsautomaten enthält, um eine Hochstromentladung möglichst schnell zu unterbrechen. Diese Sicherung bietet jedoch unter Umständen keinen vollständigen Schutz gegen eine Lichtbogenentladung, die dann zustande kommen kann, wenn die Kontakte des Akkumulators kurzgeschlossen werden. Die folgenden Sicherheitsmaßnahmen für BP-PRO-Akkumulatoren sind unbedingt zu beachten, um eine Verletzungsgefahr auszuschließen.

Verbrauchte NiCd-Akkumulatoren NICHT ins Feuer werfen oder mit alltäglichem Abfall entsorgen. NiCd-Akkumulatoren können explodieren, wenn man sie einer offenen Flamme aussetzt. Sie stellen Gefahrstoffe dar und können zur Verseuchung von Grundwasser führen, wenn sie mit dem alltäglichen Abfall entsorgt werden.

Verbrauchte NiCd-Akkumulatoren zum Recyclen oder zur vorschriftsmäßigen Entsorgung an die nächste Wavetek-Niederlassung zurücksenden (siehe Recycling-Angaben unten). Die folgenden Sicherheitsmaßnahmen betreffen den Umgang mit BP-PRO-Akkumulatoren:

Solange ein Akkumulator nicht im Hand- bzw. Ladegerät eingebaut ist, muß er in einer sauberen, trockenen und nicht leitfähigen Verpackung aufbewahrt werden. Dazu sind dem LANTEK PRO/PRO XL zwei Schutzkappen aus Kunststoff beigefügt.

— Leitfähige Stoffe stets von den Kontakten fernhalten.
— Die Kontakte der Akkumulatoren stets voneinander getrennt halten.
— BP-PRO-Akkumulatoren nur in dem Doppelfach-Ladegerät von Wavetek aufladen. Falls man ein anderes Ladegerät verwendet oder nach einem anderen Verfahren die Akkumulatoren auflädt, kann es zu Explosionen kommen.
— Akkumulatoren nie in einer explosionsgefährdeten Atmosphäre ein- und ausbauen, lagern und aufladen.
— Akkumulatoren nur an solchen Orten verwenden und lagern, wo die Temperatur 50°C nicht übersteigt.
— Kinder oder Personen, die nicht auf die in diesem Handbuch enthaltenen Sicherheitsmaßnahmen aufmerksam gemacht wurden, dürfen die Akkumulatoren nicht benutzen oder aufzuladen.
— Die Akkumulatoren im geschlossenen Gehäuse belassen. Das Gehäuse enthält keine Elemente, die Service oder Wartung seitens des Anwenders erfordern. Die enthaltenen Akkumulatoren sind nicht austauschbar gegen andere Typen.

DOPPELFACH-LADEGERÄT SICHERHEITSVORKEHRUNGEN BEIM BETRIEB

Um die Gefahr eines elektrischen Schlages bzw. Geräteschäden zu vermeiden, alle Sicherheitsvorkehrungen vor dem Anschluß ans Netz sorgfältig lesen und befolgen

- Die eingestellte Netzspannung vor dem Gebrauch kontrollieren. Stellen Sie sicher, daß der grüne Pfeil am IEC-320-Steckerfeld auf den entsprechenden Wechselspannungswert zeigt.
- Das Ladegerät vor Regen und Feuchtigkeit schützen. Den Betrieb des Ladegerätes sofort einstellen, falls es naß oder feucht geworden ist.
- Das Ladegerät bzw. das Netzkabel nur verwenden, wenn beide unbeschädigt sind.
- Stellen Sie sicher, daß das mit dem Ladegerät mitgelieferte Netzkabel den nationalen Sicherheitsnormen Ihres Landes entspricht. Im Zweifelsfall setzen Sie sich mit der nächsten Wavetek-Niederlassung in Verbindung.
- Die Akkumulatorenwannen frei von leitfähigen Stoffen und sonstigen Gegenständen halten. Das Ladegerät immer vom Netz trennen, bevor Sie in die Wannen fassen, um etwaige Gegenstände zu entfernen.
- Nur BP-PRO-Akkumulatoren von Wavetek im Ladegerät aufladen. Bei anderen Akkumulatoren besteht Explosionsgefahr, was zu Verletzungen und Sachschäden führen kann.
- Das Gehäuse des Ladegerätes muß geschlossen bleiben. Es enthält keine Bauteile, die Service oder Wartung seitens des Anwenders erfordern.
- Die Sicherungen nur gegen solche mit dem spezifizierten Strom-/Spannungs-Wert austauschen. Es wird empfohlen, nur Sicherungstypen zu verwenden, die am Geräteschild (siehe Unterseite des Ladegerätes) bzw. im Handbuch angegeben sind.
- Um eine Überhitzung zu vermeiden, stellen Sie sicher, daß die Entlüftungsöffnungen des Ladegerätes immer frei sind und die Belüftung ausreicht, um den im Handbuch angegeben Arbeitstemperaturbereich sicherzustellen.
- Die eingebaute IEC-320-Steckdose weist Sicherheitsmerkmale auf, die dazu gedacht sind, vor Verletzungen und Geräteschäden zu schützen. Unternehmen Sie nichts, was diese Sicherheitsmerkmale zunichte machen könnte. Versuchen Sie auch nicht, die IEC-320-Steckdose zu öffnen, während das Ladegerät am Netz angeschlossen ist. Im Kapitel 1 des Handbuches finden Sie Angaben zur eingebauten IEC-320-Steckdose sowie Hinweise, wie man die Netzspannung einstellt und Sicherungen austauscht.

Falls das Ladegerät oder dessen Netzkabel feucht oder beschädigt sind bzw. das Gerät nicht ordnungsgemäß arbeitet, senden Sie es zur Reparatur an die nächste Wavetek-Niederlassung (siehe Kapitel 7: Kundendienst und Garantie).

HAFTUNGSERKLÄRUNG

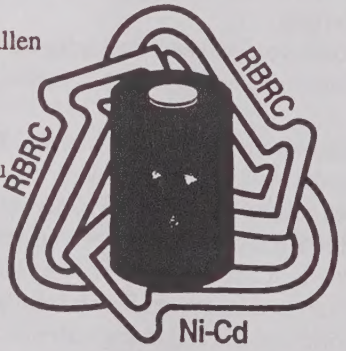
Wavetek haftet NICHT für Tod, Verletzungen, Geräte- oder Sachschäden, die darauf zurückzuführen sind, daß das Ladegerät nicht seinem Zweck entsprechend eingesetzt wird. Wavetek haftet auch nicht für direkte oder Folgeschäden, die durch unbefugten Gebrauch der Batterien bzw. des Ladegerätes verursacht werden.

ALLE NiCd-AKKUMULATOREN RECYCELN

Schützen Sie die Umwelt. Wiederaufladbare NiCd-Akkumulatoren stellen die effektivste langlebige Stromversorgung für tragbare Elektronikgeräte dar. Weil sie wieder aufgeladen werden können, sind sie umweltfreundlicher als die normalen Kohleblei-Batterien, da weniger Blei und sonstiger chemischer Abfall entsorgt werden muß.

Nachdem sie verbraucht sind, müssen NiCd-Akkumulatoren nach den örtlichen Umweltschutzbestimmungen entsorgt werden.

Verbrauchte NiCd-Akkumulatoren NICHT ins Feuer werfen oder mit alltäglichem Abfall entsorgen. NiCd-Akkumulatoren können explodieren, wenn man sie einer offenen Flamme aussetzt. Sie stellen Gefahrstoffe dar und können zur Verseuchung von Grundwasser führen, wenn sie mit dem alltäglichen Abfall entsorgt werden. Verbrauchte NiCd-Akkumulatoren zum Recyceln oder zur vorschriftsmäßigen Entsorgung an die nächste Wavetek-Niederlassung zurücksenden.



Das neue RBRC-Recycling-Zeichen, das Sie oben und an allen BP-PRO-Akkumulatoren sehen, weist darauf hin, daß Wavetek an einem nationalen Programm zum Recyceln aller NiCd-Akkumulatoren teilnimmt. Das Programm ist jetzt erst ins Leben gerufen worden, und Wavetek gehört zu den ersten Firmen, die an diesen freiwilligen Umweltschutzmaßnahmen teilnehmen. Akkumulatoren mit dem RBRC-Zeichen sollen an die nächste Wavetek-Niederlassung oder ein RBRC-Sammelcenter zurückgesandt werden, wo sie dann ordnungsgemäß recycelt werden. Die Kosten für den Versand vom RBRC-Sammelcenter an die Recycling-Anlage sowie für das Recyceln der Batterien innerhalb der USA werden von Wavetek getragen.
Außerhalb der USA setzen Sie sich mit der nächsten Wavetek-Niederlassung in Verbindung, wenn die Akkumulatoren Ihres LANTEK PRO/PRO XL verbraucht sind. Sie wird Ihnen gern Auskünfte über Recycling-Programme in Ihrem Land geben.

DIE UMWELT DANKT ES IHNEN

Falls Sie irgendwelche Fragen zu diesen Sicherheitsvorkehrungen und der Bedienungsanleitung oder sonstige Fragen zum sicheren Betrieb der BP-PRO-Akkumulatoren bzw. des Doppelfach-Ladegerätes haben, setzen Sie sich mit der nächsten Wavetek-Niederlassung in Verbindung (Anschriften: siehe Kapitel 7).

MESURES DE SECURITE

Veuillez lire toutes les mesures de sécurité avant de manipuler les accus ou d'utiliser le chargeur d'accus

MANIPULEZ LES ACCUS AVEC SOIN

• ATTENTION – Tous les accus nickel-cadmium, indépendamment de leur état de charge affiché, sont capables de générer des courants électriques qui peuvent occasionner des blessures corporelles ou des dégâts matériels.
• Wavetek a essayé d'apporter une sécurité maximale en installant une protection automatique dans chaque accu afin d'arrêter un courant de décharge important le plus rapidement possible. Cependant, cette protection peut ne pas arrêter un arc momentané qui résulte quand les contacts électriques de l'accu sont court-circuités. Afin d'éviter tout risque de blessure avec les accus BP-PRO, veuillez respecter strictement les mesures de précautions suivantes.

• Ne jetez pas vos accus Ni-Cd usés dans un feu ou avec vos déchets ordinaires. Les accus Ni-Cd peuvent exploser lorsqu'ils sont exposés au feu, produire des déchets dangereux et contaminer l'eau de surface s'ils sont déposés sur une décharge publique.
• Retournez vos accus Ni-Cd usés à votre distributeur pour recyclage ou mise hors d'usage selon les lois et réglementations locales. Veuillez suivre les informations de recyclage sur les pages suivantes.

Pour manipuler les accus BP-PRO, observez les précautions suivantes:
– Si un accu n'est pas installé dans une unité LANTEKPRO ou dans le chargeur, gardez le dans un conteneur sec et non-conducteur. Deux boîtes de protection en plastique sont fournies avec les LANTEKPRO/PROXL pour cet usage.
– Gardez toujours les matériaux conducteurs à l'écart des contacts de l'accu.
– Gardez toujours les contacts d'un accu éloignés des contacts d'un autre accu.
– N'utilisez que le chargeur Wavetek à double baie pour charger les accus BP-PRO. Si vous chargez les accus avec d'autres chargeurs ou d'une autre manière, ils risquent d'exploser.
– Installez, enlevez, stockez et chargez les accus toujours dans une atmosphère non-explosive.
– Utilisez et stockez les accus à une température ne dépassant pas les 50°C.
– Ne permettez pas aux enfants ou aux personnes qui n'ont pas été informées des mesures de précaution indiquées dans ce manuel de manipuler ou de recharger les accus.
– N'enlevez pas les accus de leur boîtier étanche. Il n'y a pas pièces sujettes à maintenance par l'utilisateur à l'intérieur du boîtier, et les accus dans le boîtier ne peuvent être remplacés.

INSTRUCTIONS D'UTILISATION POUR LE CHARGEUR D'ACCUS À DOUBLE BAIE

Lisez et suivez toutes les précautions avant de connecter le chargeur au secteur, afin d'éviter tout risque de choc électrique ou de dégâts matériels

• Vérifiez la sélection de tension AC avant usage. La flèche verte sur le module d'alimentation IEC320 doit pointer vers la tension qui correspond à votre tension de secteur.
• Protégez le chargeur de la pluie ou autres sources d'humidité, et arrêtez l'usage immédiatement quand vous détectez une telle exposition.
• N'utilisez le chargeur et son cordon d'alimentation que s'ils ne sont pas endommagés.
• Verifiez si le cordon d'alimentation fourni est du bon type pour votre prise secteur. S'il ne l'est pas, échangez-le chez votre distributeur avant de raccorder le chargeur au secteur.
• Assurez-vous qu'il n'y a pas de matériaux conducteurs ou autres objets dans les baies du chargeur. Déconnectez le chargeur du secteur avant d'enlever tout objet ou débri des baies.
• Ne chargez que des accus Wavetek BP-PRO avec ce chargeur. D'autres accus pourraient exploser et causer des blessures corporelles et dégâts matériels, et détruire le chargeur.
• Le boîtier de l'accu doit rester fermé et étanche. Il ne contient pas de pièces sujettes à maintenance.
• Les fusibles ne peuvent être remplacés que par des fusibles avec des valeurs de tension et de courant adéquates. Wavetek recommande d'utiliser le type de fusible marqué sur l'étiquette du chargeur (en-dessous du boîtier) et comme indiqué dans ce manuel.
• Afin d'éviter une surchauffe, assurez-vous que les fentes de ventilation ne sont pas obstruées et qu'il y a assez de courant d'air pour le refroidissement afin de maintenir les conditions d'environnement décrites dans le chapitre de spécifications de ce manuel.
• Le module d'alimentation IEC-320 contient des dispositifs de sécurité pour prévenir les blessures corporelles et dégâts matériels. N'essayez pas de neutraliser ces dispositifs, ou d'ouvrir le module alors qu'il est connecté au secteur. Voyez le chapitre 1 de ce manuel pour instructions concernant le module IEC-320 et la manière de changer le choix de la tension et les fusibles.

Si, à n'importe quel moment, le chargeur ou le câble d'alimentation sont exposés à l'humidité, sont endommagés, ou ne fonctionnent pas correctement et en accord avec ce manuel, renvoyez le chargeur à votre distributeur local pour réparation par un service autorisé, ou pour une mise hors service correcte. Référez-vous au chapitre 7 de ce manuel, Service Clientèle et Garantie, pour de plus amples informations.

DECLARATION DE RESPONSABILITÉ

Wavetek ne peut pas être tenu pour responsable pour un accident mortel, des blessures ou des dégâts matériels résultants d'un usage de ce chargeur non conforme avec l'usage pour lequel il a été conçu. Wavetek ne peut pas être tenu pour responsable des suites qui peuvent résulter d'une modification des accus ou du chargeur ou des conséquences d'une utilisation après une telle modification.

RECYCLEZ TOUTES LES PILES Ni-Cd

Protégez l'environnement! Les accus nickel-cadmium procurent la source de courant longue-durée la plus efficace pour équipements électroniques portatifs. Leur capacité de recharge les rend moins polluant pour l'environnement que des piles carbone-plomb en réduisant la quantité de plomb et de produits chimiques à écarter.

Quand les accus sont usés, ils doivent être éliminés en accord avec les réglementations locales pour l'environnement concernant les accus nickel-cadmium (Ni-Cd).

• Ne jetez pas les accus Ni-Cd dans un feu ou avec des déchets ordinaires. Les accus Ni-Cd peuvent exploser si exposés à des flammes, créer des déchets dangereux, et contaminer l'eau de surface si déposés dans une décharge publique.
• Renvoyez les accus usés à votre distributeur local pour recyclage ou disposition selon les lois et réglementations locales.

Le sigle RBCD illustré ci-dessus et sur tous les accus BP-PRO indique que Wavetek a payé les droits de participation dans un programme national pour le recyclage des accus Ni-Cd. Ce programme national vient d'être créé, et Wavetek est une des premières sociétés à participer dans ce programme volontaire de protection de l'environnement. Les accus portant le sigle RBRC doivent être retournés à votre distributeur ou n'importe quel centre de collecte RBRC pour recyclage. Les frais d'expédition d'un centre de collecte RBRC vers un centre de recyclage ainsi que les frais de recyclage dans les États Unis d'Amérique ont déjà été payés par Wavetek.

A l'extérieur des États Unis d'Amérique, si vous avez un accu LANTEKPRO/PRO XL, contactez votre distributeur Wavetek local pour informations concernant un programme de recyclage dans votre région.

MERCI POUR VOTRE AIDE DANS LA PROTECTION DE L'ENVIRONNEMENT

Si vous avez des questions concernant ces précautions, les instructions d'utilisation, ou d'autres remarques concernant l'utilisation sûre des accus BP-PRO ou le chargeur d'accus double-baie, contactez le représentant Wavetek dont vous trouvez les détails d'adresse dans le chapitre 7 de ce manuel "Service Clientèle et Garantie".

PRECAUCIONES DE SEGURIDAD

Lea todas las precauciones antes de usar cualquier tipo de batería o antes de usar El Recargador de Batería Doble

MANEJE TODO PAQUETE DE BATERÍA CON MUCHO CUIDADO.

PRECAUCIÓN - Todo paquete de batería de níquel-cadmio, sin importar la carga que indique, puede producir una descarga eléctrica lo suficientemente fuerte para causar daños personales o de propiedad.

WAVETEK a tratado de ofrecer la máxima protección posible instalando un fusible automático en cada paquete. Esto ayudará rápidamente a detener descargas de alto voltaje. Pero este fusible, no producirá completa protección contra choques eléctricos momentáneos.

Como es indicado por las instrucciones de manejo de los paquetes de baterías BP-PRO, las siguientes precauciones deberán seguirse para evitar y evadir riesgos de accidentes:

No destruya los paquetes de baterías de níquel-cadmio tirándolos al fuego o en la basura. Las baterías de níquel-cadmio, pueden explotar si son expuestas a llama viva o contaminar los orígenes de las aguas subterráneas si son tiradas en terrenos baldíos.

Retorne las baterías usadas a su distribuidor local para un apropiado reciclaje o destruyalas de acuerdo con las leyes y regulaciones locales. Favor de observar y guiarse por la información de reciclaje contenida en las subsiguientes paginas:

1. Cuando una batería no está instalada en un instrumento o en el recargador, deberá guardarse en un paquete el cual no sea conductivo de energía y este seco y limpio. Para este propósito, dos paquetes protectores de plástico son incluidos con el LANTEK PRO y el LANTEK PRO XL.
2. Mantenga las baterías alejadas de materiales sumamente conductivos.
3. Mantenga los contactos (+, -) de los paquetes de baterías alejados uno del otro.
4. Utilice solamente El Recargador de Batería Doble manufacturado por Wavetek para recargar los paquetes de baterías BP-PRO. Recargándolos con otro tipo de cargador puede causar una explosión.
5. Siempre instale, remueva, guarde, y recargue sus baterías en un ambiente con atmósfera no explosiva.
6. Use y guarde sus baterías en lugares que no excedan mas de 50 grados Celsius de temperatura.
7. No permita que niños o personas que no estén familiarizadas con estas instrucciones y precauciones, toquen, manejen o recarguen los paquetes de baterías.
8. No desmantele la envoltura de los paquetes de baterías. Adentro del paquete, no existen partes las cuales puedan ser reusables o remplazables.

RECARGADOR DE BATERÍAS DOBLES OPERACIONES Y PRECAUCIONES.

Para evitar riesgos de choques eléctricos y daños de equipo lea y siga todas las precauciones e instrucciones antes de conectar la corriente eléctrica.

- Antes de conectar el equipo, chequee el voltaje de la corriente eléctrica. Asegúrese que la flecha verde del indicador en el tablero conector del panel IEC-320 este apuntando asía el correcto voltaje de su área local.
- Proteja el cargador de batería contra la lluvia o humedad. Discontinúe su uso si a sido expuesto a estos elementos.
- Antes de utilizar el cargador o el alambre eléctrico asegúrese que no estén dañados.
- Asegúrese que el alambre eléctrico del cargador de batería es el adecuado para su área geográfica. Si no es el indicado, no conecte su equipo a la corriente eléctrica sin antes obtener de parte de su distribuidor el alambre correcto.
- Maneje el compartimiento de las baterías limpio y libre de materias conductivas. Desconecte el cargador antes de remover toda partícula u objeto en el compartimiento.
- Utilice el Recargador de Baterías Dobles únicamente para cargar las baterías BP-PRO manufacturadas por Wavetek. Otro tipo de batería puede explotar causando graves daños tanto personales como de inmuebles.
- El recargador no debe de abrirse ni su sello debe ser roto. Ninguna de sus partes son reusables.
- Reemplace los fusibles solamente con fusibles que tengan el mismo voltaje y amperaje. Wavetek recomienda el uso de la lista de fusibles que se encuentra debajo del recargador o en el manual.
- Para prevenir sobrecalentamientos, asegúrese que las ventanas de ventilación del recargador no están obstruidas y que haya suficiente flujo de aire frío. Observe los adecuados limites de temperatura recomendados en el manual de servicio.
- El conector IEC-320 a sido diseñando con medidas de seguridad para la protección personal y del equipo. No trate de interferir con estas medidas o de abrir el conector IEC-320 mientras esté acoplado a un zócalo eléctrico. Para cambiar el voltaje o los fusibles, favor referirse al Capítulo # 1 del manual de instrucciones.

Si en cualquier momento, el cargador o el alambre eléctrico son expuestos a la humedad, o son dañados, o si el cargador no esta funcionando adecuadamente, el equipo deberá ser retornado a su distribuidor local y reparado por un representante autorizado de Wavetek. Para mayor información favor leer el Capítulo # 7 del manual de servicio.

DECLARACIÓN DE RESPONSABILIDADES.

Wavetek no asume ninguna responsabilidad por accidentes daños o muertes causadas por el abuso o el mal uso de el cargador. Wavetek no se hace responsable por daños que puedan ocurrir por forzar abrir o romper el paquete de baterías, o el cargador, o el resultado producido por equipo cuya integración haya sido violada.

RECICLE TODO PAQUETE DE BATERÍA DE NÍQUEL-CADMIO.

Por favor proteja el medio ambiente. Los paquetes de batería de níquel-cadmio son recargables y por lo tanto proveen la mas larga y eficiente fuente de energía para todo tipo de equipo electrónico portable. Su capacidad de recarga los convierte en menos dañinos para el medio ambiente que las baterías de carbón y plomo.

Cuando tenga que deshacerse de los paquetes de batería de níquel-cadmio, favor de consultar y seguir al pie de la letra las leyes y regulaciones locales.

No destruya los paquetes de baterías de níquel-cadmio tirándolos al fuego o en la basura. Las baterías de níquel-cadmio, pueden explotar si son expuestas a llama viva o contaminar los orígenes de las aguas subterráneas si son tiradas en terrenos baldíos.

Retorne las baterías usadas a su distribuidor local para un apropiado reciclaje o destruyalas de acuerdo con las leyes y regulaciones locales.

El RBRC símbolo que aparece arriba y en todo paquete de batería BP-PRO, indican que Wavetek ha pagado los derechos de licencia por la participación en el programa nacional de reciclaje de baterías de níquel-cadmio. Este programa nacional fue lanzado recientemente y Wavetek fue una de las primeras compañias en adoptar y participar en los esfuerzos para proteger el medio ambiente.

Los paquetes de baterías con el símbolo RBRC deberán ser enviados a su distribuidor o a un centro de reciclaje RBRC. Los gastos de correo dentro de los Estados Unidos han sido pagados en anticipación por Wavetek. Si usted vive o trabaja fuera de los Estados Unidos y posee un LANTEK PRO o LANTEK PRO XL con un paquete de baterías gastadas, favor contactar a un distribuidor autorizado de Wavetek para información de los varios programas de reciclajes disponible en su área.

GRACIAS POR ALLUDARNOS A PROTEGER EL MEDIO AMBIENTE.

Si tiene alguna pregunta concerniente a estas precauciones e instrucciones de uso, o alguna otra pregunta acerca del paquete de baterías BP-PRO o del cargador de batería doble, favor contactar a uno de los representativos de Wavetek en las oficinas enumeradas en el Capítulo # 7 del manual de servicios.

Important User Information

Please read this information before proceeding with any cable testing/certification using the LANTEK PRO / LANTEK PRO XL.

All the cable parameter default settings preprogrammed in the LANTEK PRO / LANTEK PRO XL are based on generic standards, proposed industry recommendations for cables and network links, the latest technical information available from TIA/EIA committees, the LAN industry and Wavetek's own experience and testing. However, the default settings in the LANTEK PRO / LANTEK PRO XL may not yield the desired certification / test results in every given instance because each network is a custom installation designed to suit the requirements of the users. It is therefore imperative that specific network parameter limits be obtained from the network designer(s) and employed during certification and testing.

Refer to Chapter 2 for information and instructions on how to select the correct cable type, change testing methods, and customize the cable's parameters for certification and testing. Appendix B provides a complete list of preprogrammed cable types and their default parameter settings.

Table of Contents

Chapter 1: Getting Started

The Display Handset 1-1
The Remote Handset 1-4
Batteries & Dual Bay Battery Charger 1-6
Using the LANTEK PRO 1-11
Test Connections 1-13
Calibration 1-15
Connecting to a Printer 1-17
LANTEK PRO Series & Accessories 1-18
LANTEK PRO Series Support Strap 1-22
Using On-line Help 1-23
Uploading Firmware Upgrades 1-24

Chapter 2: Using Setup

Setting & Customizing Cable Types 2-1
Selecting Autotest Preferences 2-10
Performing Field Calibration 2-13
Using Custom Cable Settings 2-15
Setting Printer/Serial Port Configuration 2-17
Changing the Date and Time 2-19
Selecting Units of Measurement 2-21
Setting Power-Off Delay 2-22
System Information & Factory Tests 2-23
User Information 2-25

Chapter 3: Using Autotest

Running Autotest 3-1
Viewing Autotest Results 3-5
Viewing Saved Test Results 3-7
Printing Autotest Results 3-9
Saving Autotest Results 3-13
Naming Autotest Results 3-15
Line Map 3-17
DC Resistance 3-19
Length 3-21
Capacitance 3-23
Attenuation 3-24
Dual Near End Crosstalk (Dual NEXT) 3-26
Attenuation-to-Crosstalk Ratio (ACR) 3-29

Average Impedance 3-31
Delay 3-33
Return Loss 3-35

Chapter 4: Using Fault Find

Running Fault Find 4-1
Running Cable Expert 4-3
Line Map 4-5
DC Resistance 4-7
Length 4-9
Capacitance 4-11
Near End Crosstalk (NEXT) 4-13
Attenuation 4-15
Using the TDR (downline impedance graph) 4-17
TDR (LANTEK PRO XL only) 4-20
Average Noise (LANTEK PRO XL only) 4-24
Return Loss 4-26
Average Impedance 4-28

Chapter 5: Managing Test Results

Saving Test Results 5-1
Viewing Test Results 5-5
Printing Test Results 5-7
Printing Fault Find Results 5-9
Renaming Test Results 5-11
Uploading Test Results to a Computer 5-14
Utility Software 5-15

Chapter 6: Testing & Troubleshooting

System Under Test 6-2
Testing Twisted Pair Systems 6-4
Troubleshooting Twisted Pair Systems 6-7
Testing 10BASE-T Cabling 6-16
Testing Token Ring Cabling 6-17
Testing With Special Adapters 6-19
Testing 10BASE-2 Cabling 6-21
Troubleshooting 10BASE-2 Cabling 6-23
Testing 10BASE-5 Cabling 6-27
Troubleshooting 10BASE-5 Cabling 6-28
Testing With Twinax Cable 6-29

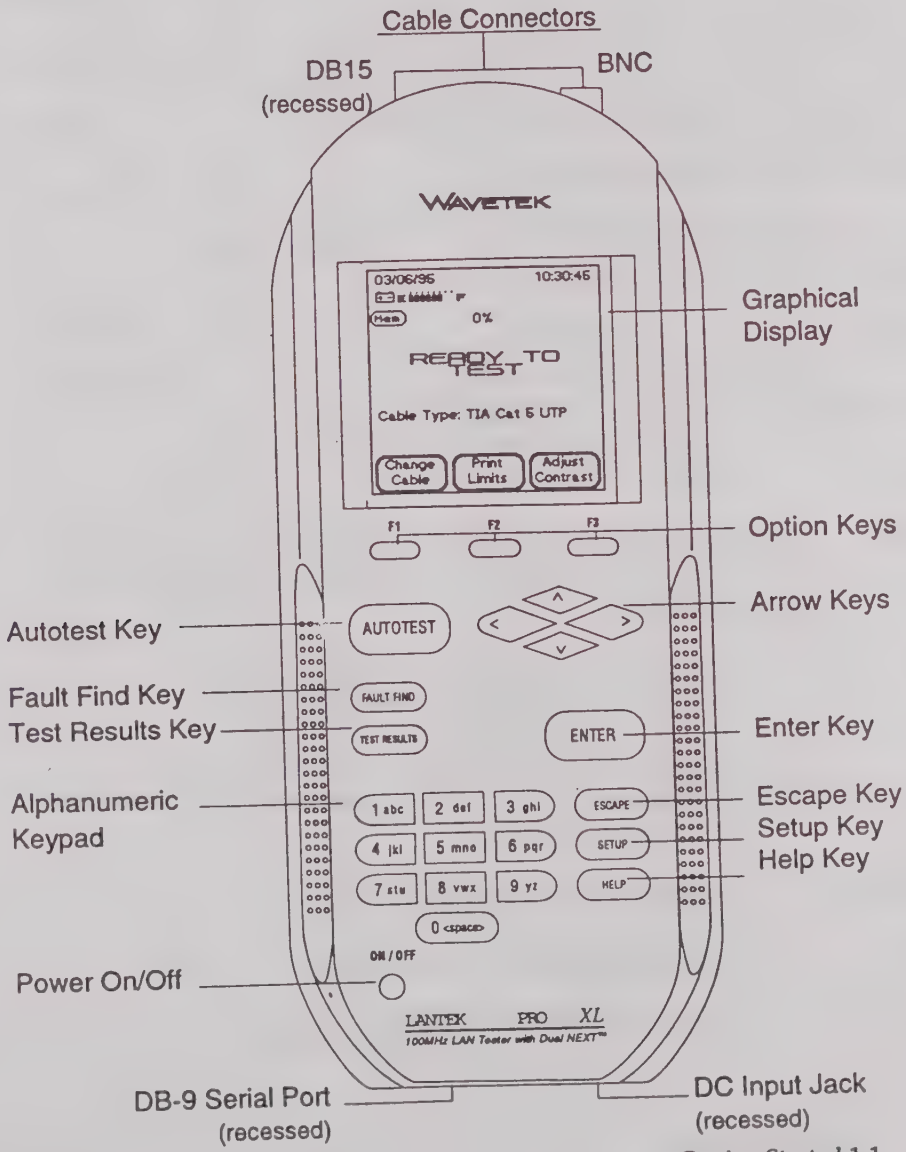
Chapter 7: Customer Service and Warranty

Service In the USA 7-1
Service Outside the USA 7-2
Web and Bulletin Board Service 7-3
Warranty Information 7-4

Glossary *G-1*
Appendix A: Specifications *A-1*
Appendix B: Cable Configuration *B-1*

1 Getting Started

The Display Handset



The Display Handset

Controls and operates all tests, working in tandem with the Remote Handset.

The LANTEK PRO is a high-performance, portable 100 MHz LAN cable tester designed to test and measure twisted pair and coaxial cable used for high speed data communications networks.

The LANTEK PRO consists of a Display Handset and Remote Handset that connect to opposite ends of a cable system link. The Display Handset controls both units and performs all operational functions for testing, saving, printing, or downloading results to a PC.

The Display Handset will operate for up to 8 hours on a single battery charge under normal operating conditions.

The Display Handset provides the following features:

Alphanumeric Keys	Use to enter number, letter or special characters. Also selects numbered menu options.
Arrow Keys	Allows the user to scroll vertically and horizontally to select tests, options or move a graph cursor.
Autotest	Performs a fast, comprehensive suite of tests for line map, length, DC resistance, capacitance, Dual (two-way) NEXT, attenuation, and attenuation-to-crosstalk ratio (ACR). Test results are presented as pass/fail with detailed text and graphs.
Cable Connectors	DB-15 and BNC female connectors.
Enter Key	Selects menu choice; saves changes.
Escape Key	Aborts and exits without making changes.

Fault Find	Provides Cable Expert troubleshooting program and individual, continuous-mode tests for line map, DC resistance, length, attenuation, NEXT, capacitance, average noise (XL only), TDR impedance over length (XL only).
Graphical Display	Presents menus, test results, graphs, action choices and option keys (F1-F3).
Help Key	Displays on-line help and technical glossary.
Option Keys (F1-F3)	Selects menu options displayed on screen.
On/Off	Powers Display Handset on/off.
Serial Port	300-38400 serial port for downloading stored tests, printing graphs and updating Flash ROM.
Setup Key	Accesses menu to configure operation.
Test Results	Use to access stored test results and print, delete or rename tests.

Keyboard Conventions

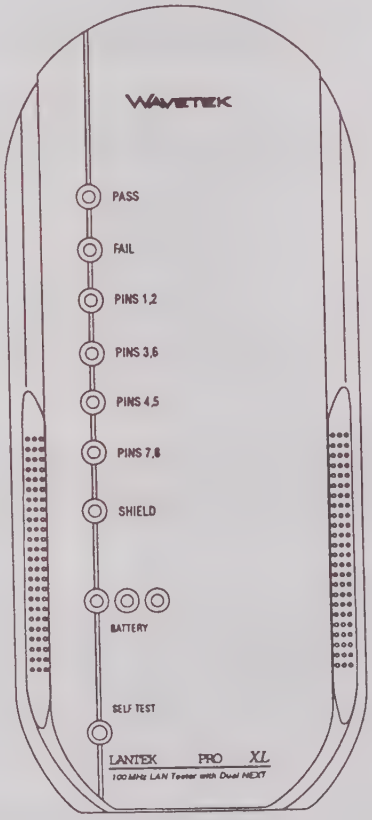
Escape key returns Display to previous screen without making changes. Use repeatedly to back out of menus.

The Remote Handset

Terminates the cable link and communicates with the Display Handset.

The Remote Handset works with the Display Handset to perform the Autotest or individual diagnostic tests.

The Remote Handset is automatically activated by the Display Handset and does not have a separate power-on key. During cable testing, the Display Handset searches for the Remote Handset. If the two handsets are unable to establish communication, the Display Handset gives an error message. Check the links to verify proper connection.



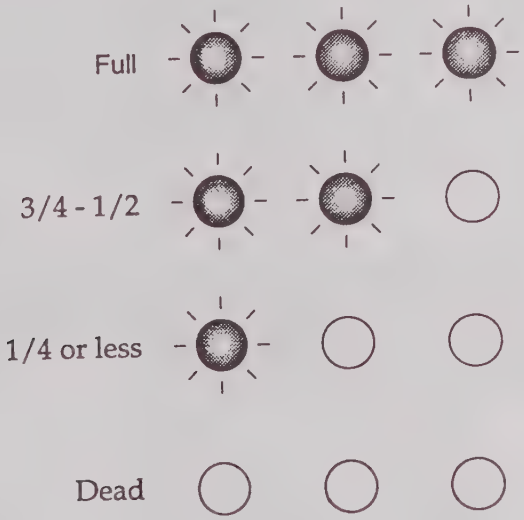
After five seconds of inactivity, the Remote Handset automatically powers down to save battery power. The Remote Handset operates for up to ten hours on a single battery charge under normal conditions.

The Remote Handset does not have a graphic display; it uses a series of LEDs to indicate operational status. The top two LEDs indicate pass or fail test results.

The third through sixth LEDs represent pins: 1,2; 3,6; 4,5; 7,8 in these pair combinations. These LEDs indicate wiring mismatches or other problems. When a fail is indicated on the second LED (red), the failed pair is indicated by a lighted LED.

The seventh LED from the top indicates shield integrity. A shield continuity test failure is indicated by a lighted LED.

The horizontal row of three LEDs near the bottom of the remote indicate battery power at high, half and low. The one yellow and two green LEDs indicate the battery pack power level as follows:



The **Self Test** key performs two functions: to verify that the Remote Handset is operational and to power up the Remote Handset when performing software upgrades. Press the **Self Test** key lightly and release quickly to initiate the self test. All LEDs should light in sequence. The battery LEDs will stay on for 3 seconds, indicating power remaining.

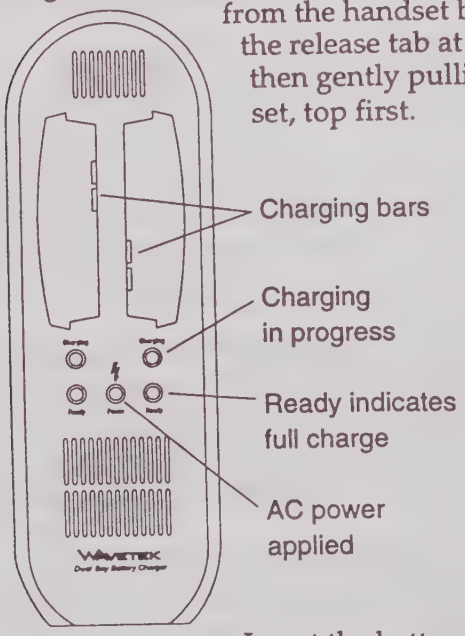
For performing upgrades, hold down the **Self Test** key for 2 seconds and the unit will power up, beep and remain on for 15 seconds to perform software uploads.

Batteries & Dual Bay Battery Charger

Recharges two nickel-cadmium batteries in approximately 3 hours.

Both the Display and Remote Handsets use interchangeable, rechargeable nickel cadmium battery packs. The Display Handset can be powered for approximately eight hours; the Remote Handset for ten hours. To ensure maximum battery pack performance, use the batteries until power is low before recharging. Repeated partial discharge and charge can decrease battery life.

The dual bay battery charger allows two battery packs to be charged simultaneously. To recharge a battery pack, remove it from the handset by first pushing down on the release tab at the top of the battery and then gently pulling away from the handset, top first.



Insert the battery packs into either side of the dual bay battery charger, being careful to align them correctly using the shape of the charging bay as a guide. Make sure the metal charging bars at the base of the battery packs align with the charging bars in the charging bays. The release tabs should be pointing up. Exert a steady, firm pressure to ensure the battery pack makes contact with the charging bars. Connect the battery charger to any 110/220 volt 50-60 Hz power outlet using the power cord provided.

If you plan to connect/disconnect the power cord at the wall, locate the battery charger near the power outlet (wall plug). If you wish to connect/disconnect the power cord at the charger's outlet socket, ensure unobstructed access to the socket area.

CAUTION: ALWAYS CHECK THE IEC 320 PLUG'S VOLTAGE SETTING ARROW PRIOR TO CONNECTING TO A WALL OUTLET

A yellow LED indicates charging is in progress for each battery pack. When each battery pack is fully charged, a green LED lights up. The charger continues to trickle charge the batteries, maintaining a full charge until the batteries are needed.

Optional spare battery packs may be purchased to allow one set to be charging while the other is being used.

Powering Handsets with the Charger

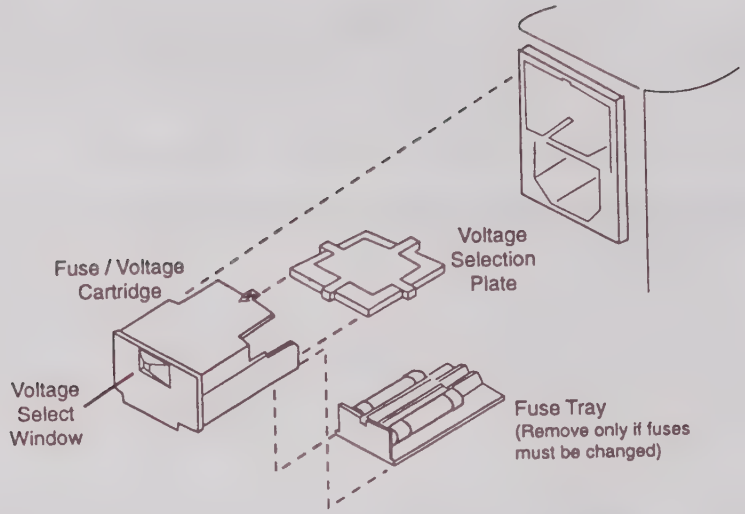
The dual bay battery charger provides a 12 VDC output jack that allows the Display or Remote Handsets to be powered using an AC current wall power outlet. Connect the battery charger to a wall outlet using the AC power cord provided. Connect the Display or Remote Handset to the charger using the DC power cord provided.

CAUTION: CHECK BATTERY CHARGER AC VOLTAGE BEFORE USE

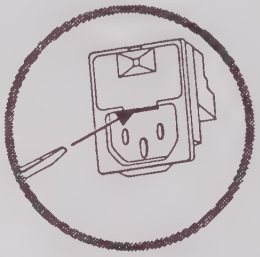
Before connecting the battery charger to wall outlet power, check the power level setting indicated by the green arrow on the charger's receptacle jack to verify match to local AC outlets. Do not exceed recommended power settings for your local area.

LANTEK PRO Settings	Local Current
120 VAC	100-200 VAC @ 50-60 Hz
240 VAC	220-250 VAC @ 50-60 Hz

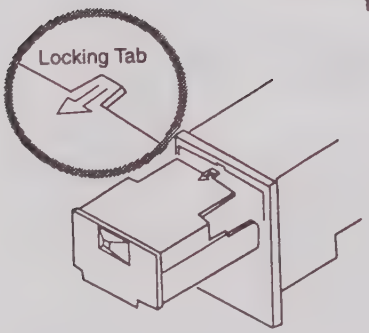
To change the setting make sure charger is not connected to wall power and batteries are removed.



(1) Remove wall power cord from the charger to expose the screwdriver slot.



(2) Insert a small, flat head screwdriver into the slot at the base of the outlet socket and pull out the fuse/voltage cartridge.



(3) Lift the locking tab on the top of the cartridge and pull out the voltage selection plate.

(4) Rotate the voltage selector and insert back in holder with selected voltage displayed through the window.

(5) Insert cartridge back into charger.

Charger Fuse Replacement

The charger uses two 1/2 ampere M, 250 volt fuses for electrical protection. Both fuses are in a fuse tray internal to the installed IEC-320 module and can be replaced in the field. The following is a list of Wavetek recommended fuse types which can be used for replacements:

Ampere	Volts	Diameter	Length
1/2A	250V	5 mm	20mm
1/2A	250V	1/4 inch	5/8 - 1 1/4 inch

There are a variety of fuse types that will satisfy the requirements of the charger. However, they must be 1/2A, 250V, rated for Medium or Normal blow and within the dimensions specified above. Some sample types are 3AG or AB, 7AG or AB, and 8AG or AB.

To check or replace the fuses make sure the charger is disconnected from wall power and perform the following steps:

(1) Remove the wall power cord's plug from the jack to expose the screwdriver slot.

(2) Insert a small flat head screwdriver at the base of the outlet socket and pull out the voltage/fuse cartridge.

(3) Lift the locking tab on the top of the fuse tray to release the tray and pull the entire tray out of the cartridge. Fuses can be checked while in the tray. A visual check is possible, but it is recommended they be continuity checked with a multimeter.

(4) If a fuse must be replaced, use a "mini" fuse puller to safely extract the fuse from the tray and insert a new fuse of equal rating and appropriate size.

(5) When both fuses are known to be good, insert the fuse tray back in the cartridge ensuring the tab lock closes.

(6) Insert the voltage/fuse cartridge back in the IEC-320 module until it snaps securely in place.

When AC power is connected the green power LED should light. If a battery is inserted in the charging well either a yellow or green battery charge state LED indication should be on. If these indications do not appear, check the following items before contacting your distributor or Wavetek Service Center:

1. Does the wall outlet have power?

2. Is the green voltage indication arrow on the IEC-320 module pointing to the correct voltage from the outlet?

3. Are you using the correct wall cord and does it have end-to-end continuity in the connectors?

4. Are both the fuses in the IEC-320 module good?

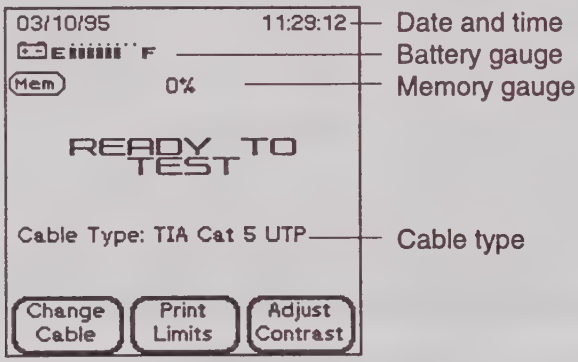
5. Is the voltage change plate correctly inserted in the cartridge and the cartridge seated properly in the IEC 320 module?

If the answer is YES to all the questions listed above, the Dual Bay Battery Charger circuitry is suspect. Contact your local distributor or one of the Wavetek Service Centers listed in Chapter 7.

Using the LANTEK PRO

The ready screen displays important information about remaining battery power, memory capacity, and cable settings. Option keys allow you to change the cable setting, print out test parameters, and adjust contrast for changing light requirements.

On power up the LANTEK PRO performs a quick self-diagnostic test and displays a ready screen when completed. An alert message is displayed if the self test determines calibration or repair is necessary. See Chapter 7: Service & Warranty for service information.



The ready screen displays date and time, remaining battery power, current memory usage, and the cable type selected. Note the date, time, and cable selection. Time and date should be accurate for test results records. Press the **Cable** option key to access the setup menu for cable type changes; the **Setup** option key to access the Setup menu for all other changes.

Check the cable type displayed to make sure it is the cable type you will be testing. The cable type selected automatically sets the test parameters and should be correct for accurate testing. Press the **Change Cable** option key to select a different cable type or to select custom test parameters.

The battery gauge approximates remaining battery capacity. The PRO has a built-in fail-safe when the battery is low or removed: Stored tests are sustained for approximately 3 days before any data loss. Regardless, users should always print or download any stored tests for redundancy.

When the battery is near empty, the LANTEK PRO displays a warning message and minutes later shuts the LANTEK PRO down before testing results are affected.

The memory gauge and percentage indicate the amount of non-volatile memory consumed by stored test results. Up to 500 Autotests can be stored. When memory is full, test results can be printed, deleted or downloaded to a computer to recover storage capabilities.

Three option keys available on the ready screen, **Change Cable**, **Print Limits** and **Adjust Contrast**, provide quick changes before testing.

Wavetek recommends a printing or PC download be accomplished daily to provide results backup protection.

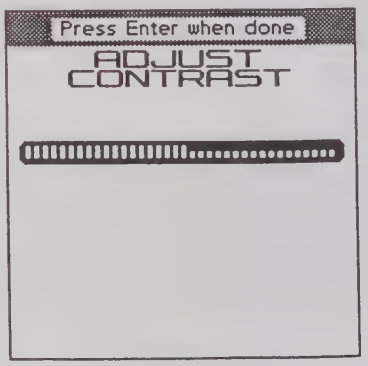
Change Cable allows quick access to cable type selection menus.

Prints Limits prints a list of all cable test parameters programmed in the PRO. Custom parameters can be set using the Setup menu.

Adjust Contrast adjusts contrast and viewing angle for different light and work environments. Press the **Adjust Contrast** option key to access the change panel.

Use the **Left/Right Arrow** keys to increase or decrease the contrast.

Press **Escape** to return to the Ready menu.



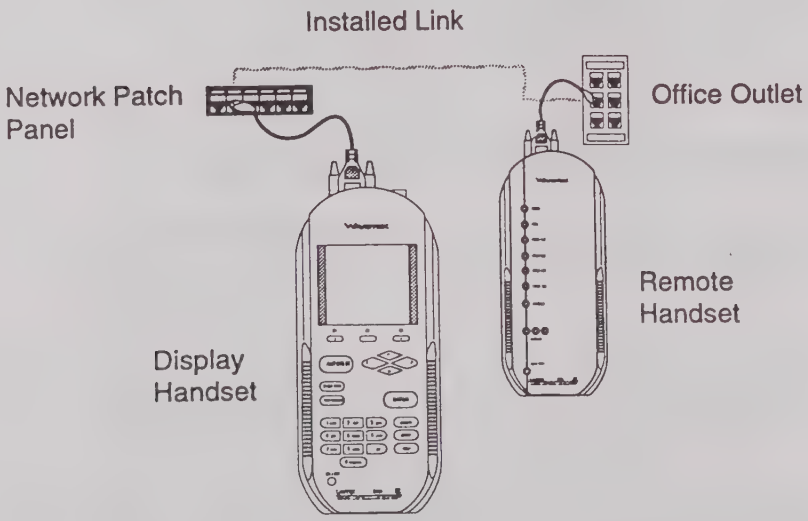
Test Connections

It's as easy as attaching the test leads to a link and pressing the Autotest key.

The LANTEK PRO comes with two types of built-in test lead connectors: a DB-15 and a BNC. The BNC connector can be used directly with connectors for RG62 and RG58 coax cable. For 10BASE5 and RG59 CATV cable, adapters are required. For UTP and STP, the LANTEK PRO uses a DB-15 connector to reduce residual crosstalk and improve accuracy.

LANTEK PRO test leads come with a male DB-15 connector on one end and an 8mp RJ-45-style, 110 block or other standard network connector on the opposite end. (For a complete list of standard and optional accessories, refer to page 1-18.)

To test a network link that is terminated in 8-pin modular jacks, connect the test leads to both the Display and Remote Handsets using the DB-15 connectors. Connect the Display Handset test lead to one end of the link and the Remote Handset lead to the opposite end as shown.



Power up the Display Handset by pressing the **On/Off** key. The Remote Handset will be powered up automatically by the Display Handset when the Autotest initiates.

CAUTION: DO NOT CONNECT TO TELCO LINES

The LANTEK PRO and LANTEK PRO XL use precision components to produce accurate test signals and test measurements. To protect these components, ensure that all cable links designated for testing are completely disconnected from live signals, particularly telco signals, before connecting the LANTEK PRO or LANTEK PRO XL to the cable system.

CAUTION: DO NOT CREATE TESTING GROUND LOOPS WITH SHIELDED CABLE SYSTEMS

Shielded cable systems (i.e., Token Ring, 4 pair STP, or Coaxial) present a unique testing problem due to the cable shield's ground connection. The LANTEK PRO /PRO XL can test these systems to specifications if the handsets are operated on battery power only and not connected to a PC or printer using a copper serial cable.

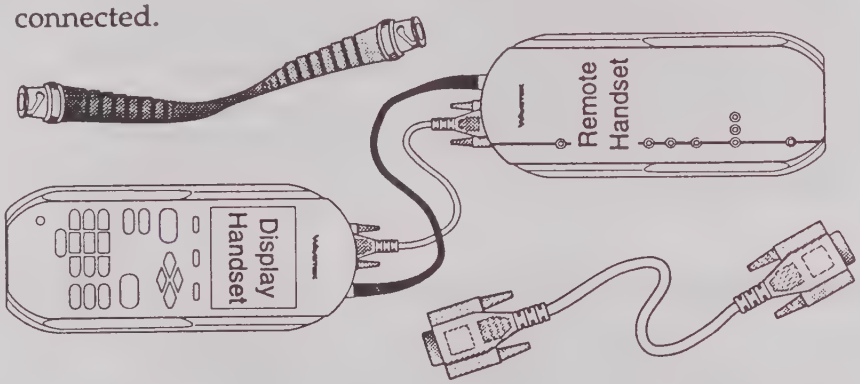
The problem centers on a difference in conductivity between the cable system's ground, the building's electrical ground and true earth ground. If shielded test leads are connected between the LANTEK PRO / PRO XL and the network cable system, and either an external power source or a serial cable is connected to the handsets, a conductive path will exist from both system grounds through the earth. This unwanted circuit path will affect testing measurements with varying degrees of impact.

If connection to a printer or PC is essential to perform testing, Wavetek recommends using battery operated devices and removing any wall power charging input to either. If this is not possible an optical-isolated serial cable should be used during testing. This will isolate the instrument from all other ground connections.

Calibration

Daily calibration takes two keystrokes and 60 seconds to assure optimum performance.

For optimum performance, the LANTEK PRO should be calibrated each day. Before calibrating, connect the Display and Remote Handsets together using the LANTEK PRO calibration connectors shown below. If you will be testing twisted pair cable only, it is not necessary to connect the coax calibration adapter. The LANTEK PRO will automatically calibrate for twisted pair only when the DB-15 adapter alone is used. If you are testing coax cable, both adapters must be connected.



If a coax cable is to be tested, select the coax cable type prior to calibration and use both cal adapters.

To calibrate, press **Setup** to access the Setup menu. Use the **Number 3** key to select or **Arrow** keys to scroll to "Perform Field Cal."

Press **F3 (START)** to activate self calibration. Calibration takes approximately 60 seconds. While calibration is in process, the PRO displays test progress and results.

When calibration is completed, the PRO displays a successful calibration message or alert message if the calibration was not successful. If calibration is not successful, contact your local distributor or a Wavetek service facility for assistance. See Chapter 7, Customer Service & Warranty.

Unsuccessful Field Calibration Correction

(1) Check the battery power on both the Display and Remote Handsets. If either the Display Handset indicates less than 2 bars off "E" or the Remote Handset indicates only the "yellow" battery power remaining (1/3), one or both may require recharging before the unit will pass calibration.

(2) Check to ensure the DB-15 calibration adapter (shown on page 1-15) is being used, has no bent pins and is correctly seated into both handsets.

(3) Check which cable type is selected. For Twisted Pair, calibration requires only the DB-15 adapter. For Coax cable selections, both the DB-15 and Coax adapters are required for calibration. The units will perform calibration with only the DB-15 adapter for any twisted pair cable selection, but requires both the DB-15 and Coaxial Adapters for coaxial cable types.

Successful Field Calibration Correction

If calibration is successful, testing can begin. Connect the LANTEK PRO to the cable outlets as shown on page 1-15 and begin testing.

Connecting to a Printer

Test results can be printed during Autotest, Fault Find or from memory using a variety of supported printers or Wavetek's PTR-1LT portable printer.

Besides its PC upload and Windows printing capability, the LANTEK PRO is compatible with a variety of serial printers and with the Wavetek PTR-1LT portable printer.

(1) Connect the LANTEK PRO to the printer serial port.
(2) Make sure the printer is powered up and on-line.
(3) When using the Wavetek PTR-1LT printer, the printer set-up is EPSON logic, 80 column mode, baud rate 9600 and DCE. The LANTEK PRO default baud rate is 9600. For other printers, determine the printer baud rate, handshake (hardware or CTS), DCE or DTE interface, and change the defaults using the Setup menu. When ASCII is selected, no graphs can be printed, and a form feed is output after each report.

For information on PC upload and printing from Windows, see the section on Utility Software in Chapter 5.

Serial Port Pin Assignments
Type: RS-232, Connector: DB-9

Pin	DTE Mode	DCE Mode
1	Data Carrier Detect	Data Carrier Detect
2	Transmit	Receive
3	Receive	Transmit
4	Data Terminal Ready	Data Terminal Ready
5	Ground	Ground
6	Data Set Ready	Data Set Ready
7	Ready To Send	Ready To Send
8	Clear To Send	Clear To Send
9	Not Connected	Not Connected
S	Shield	Shield

(DTE - DCE is selectable in the Setup menu)

Data Stream Information
Data Length: 8 bits, no parity
Start/Stop bit: 1/1
Speed: 300 to 38400 baud rate, user selectable
Control: CTS

LANTEK PRO Series Accessories

LANTEK PRO & LANTEK PRO XL come packed with everything needed for testing. The LANTEK PRO Kit has spare battery packs, extra test leads & deluxe carrying case.

LANTEK PRO XL Includes:
Display Handset
Remote Handset
Two removable battery packs
Dual Bay Battery Pack Charger
Wall Cord
Calibration Adapters (Twisted Pair and Coax)
User's Guide
Handbook of LAN Cable Testing
Set of Two Test Leads
Adjustable Support Strap
Utilities Disks
Pro-Serial-Kit
Carrying case

LANTEK PRO Includes:
Display Handset
Remote Handset
Two removable battery packs
Dual Bay Battery Pack Charger
Wall Cord
Calibration Adapters (Twisted Pair and Coax)
User's Guide
Handbook of LAN Cable Testing
Test Leads
Adjustable Support Strap
Utilities Disks
Pro-Serial-Kit
Carrying case

LANTEK PRO KIT
Accessories Kit for LANTEK PRO or PRO XL Includes:
Two Spare Battery Packs
Two Sets of Test Leads (CA-8MJ-PRO and CA-110-PRO)
Cable Management System Software (CMS PRO)
Deluxe Carrying Case (accommodates either the LANTEK PRO or PRO XL, the PTR-1LT printer and other accessories)

LANTEK PRO Series Accessories

All LANTEK PRO & LANTEK PRO XL testing accessories are constructed of cable and connectors certified to meet EIA/TIA 568, TSB-36, TSB-40A and TSB-67 requirements for Category 5 and UL Level V safety and performance criteria.

BA-110-PRO **One T-568A and one T-568B Test Lead Adapter.** Set of two test lead adapters for connection to 110 connecting blocks.

BATT-CHGR-PRO Dual Bay Battery Charger. Identical to the charger included with the LANTEK PRO/ PRO XL. Includes any specified international power cord.

BP-PRO **Spare Battery Pack.**

CA-8MJ-PRO **DB15 to 8MJ Test Lead Set.** Set of two test leads for testing installation drops with installed patch cables. Leads 6 inches (15 cm) with DB15-to-8MJ (female RJ45 style) connectors.

CHGR-AC-PRO **Off-line Switching Regulator/12VDC Output Jack.** One 6-foot (2 m) cord and international AC wall power cordset. Provides continuous power for either the Display or Remote Handset.

CMS-PRO **Cable Management System Software** for organizing and storing cable system testing information.

DCC-PRO **Deluxe Carrying Case.** Hard sided case with key locks and foam lining designed to carry the LANTEK PRO or LANTEK PRO XL, PTR-1LT Printer, PC cables, and all LANTEK PRO KIT accessories.

BNC-N	**BNC-to-N Adapters.** Set of two adapter connections to 10BASE5 coax cable. Converts N-size connection to BNC male.
CA-IBM-PRO	**Token Ring Adapter Set.** Set of two test leads for 4MB, 16MB or Enhanced IBM Token Ring testing up to 100MHz. DB15-to-IBM Enhanced UDC using IBM Type 6A approved shielded cable.
CA-STP-PRO	**STP Test Lead Set.** Set of two STP leads terminating in ruggedized shielded 8MP (RJ-45 Style) connectors. For testing shielded network installations and installed shield continuity checks.
CA-TWIN-PRO	**TWINAX Cable Adapter Set.** Includes two 1 foot (30 cm) cables with female TWINAX plug on one end and a male BNC connection on the other end.
CA-UTP-PRO	**UTP Replacement Test Leads.** Complete set of UTP replacement test leads for the LANTEK PRO or LANTEK PRO XL.
PTR-1LT	**LANTEK PRO Companion Printer.** Portable 80-column thermal printer and interface cable for the LANTEK PRO or LANTEK PRO XL. Includes battery eliminator/charger and manual.
PTR-PPR	**Thermal Printer Paper.** Three rolls for the PTR-1LT printer.
HB-1	***Handbook of LAN Cable Testing.*** A consolidated field reference guide on testing different LAN topologies. Background on all TIA/EIA 568 tests and how to troubleshoot various cable types.

Refer to the LANTEK PRO/PRO XL Accessories guide for a full description.

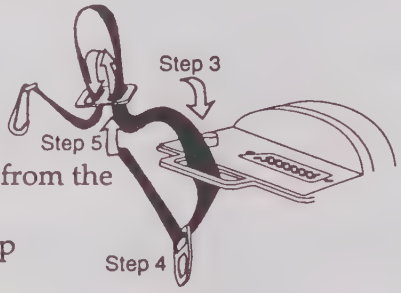
Support Strap

LANTEK PRO support strap provides secure carrying capability during use.

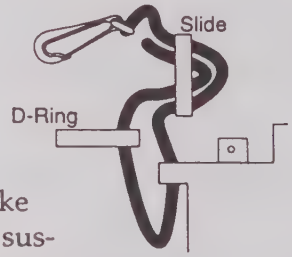
The LANTEK PRO & PRO XL come with a nylon web support strap which provides a secure way to hang and carry the Display or Remote Handset during use.

Assembly Instructions:

(1) Disassemble the strap's D-ring end by loosening the strap at the slide and removing the strap end.
(2) Remove the D-ring, leaving the slide on the strap.
(3) Slip the end of the strap through the Display Handset's support slot on the back of the PRO. Enter the slot from the top as shown.
(4) Re-install the D-ring on the strap end.



(5) Feed the end of the strap back through the slide going under the main strap.
(6) Pull the strap tight on either end of the slide as shown below, leaving at least 2 inches of strap end completely through the slide.

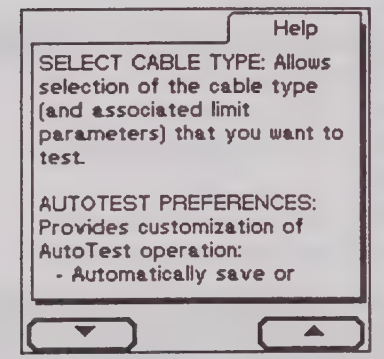


You can now adjust the strap to suit your needs. However, to prevent accidental drops, do not attempt to make strap adjustments while the handset is suspended from the strap. If the hook alone is used to hang the Display Handset, be sure the hook is completely on the support object and the safety latch is completely closed. If the support object is too large, wrap the strap around the support and fasten the hook to the D-ring. Fastening the hook over the edge of angle irons, on wide belts or other supports which do not permit the hook's safety latch to fully close is not recommended.

Using On-line Help

On-line help is available to assist you with procedures or information about tests and results.

The LANTEK PRO & PRO XL provide on-line help to assist you with information and guidance in using the LANTEK PRO and conducting LAN cable testing. On-line Help is context sensitive. When the **Help** key is pressed, specific information and options are displayed to assist you in using the menu or screen you are currently viewing.


Help
SELECT CABLE TYPE: Allows selection of the cable type (and associated limit parameters) that you want to test.
AUTOTEST PREFERENCES: Provides customization of AutoTest operation:
- Automatically save or

Use the **Arrow** keys to scroll through the help panels, if there are more than one for the subject area. The last line of each Help panel identifies the chapter in the User's Guide that will provide additional assistance.

Press **Escape** to exit the Help menu.

Uploading Firmware Upgrades

Firmware upgrades are simple and easy.

Upgrade files are available on the World Wide Web at ftp://www.wavetek.com.
Look in the public directory (Pub) for the list of available upgrades and download those you desire. Alternately, upgrades can be obtained by calling Wavetek's bulletin board system (BBS) at (619) 627-0133, International +1 (619) 627-0133. Be sure to read all the "xx README.1ST" files before performing any upgrades.

To expedite downloads, all upgrade files on these servers are compressed self-extracting .zip files. Naming conventions for these files are as follows:

LANTEK PRO/PRO XL Software	**PROVxxx.EXE**
LANTEK Utilities Software	**UTILVxxx.EXE**
CMS-PRO Software	**CMSVxxx.EXE**

The first 3-4 characters identify the instrument or software package to which the upgrade applies The "Vxxx" segment identifies the Version number (e.g., Version 1.10 will be V110), and the EXE extension indicates this is and executable file.

When downloaded they should be copied into a temporary directory on your hard drive. To expand the files run the executable file and the expansion process will begin opening the compressed files into one or more files required for the upgrade. A README.1ST file is available for download seperately and often included with the upgrade's zip file. The README.1ST file contains:

- Specific instructions on performing the upgrade

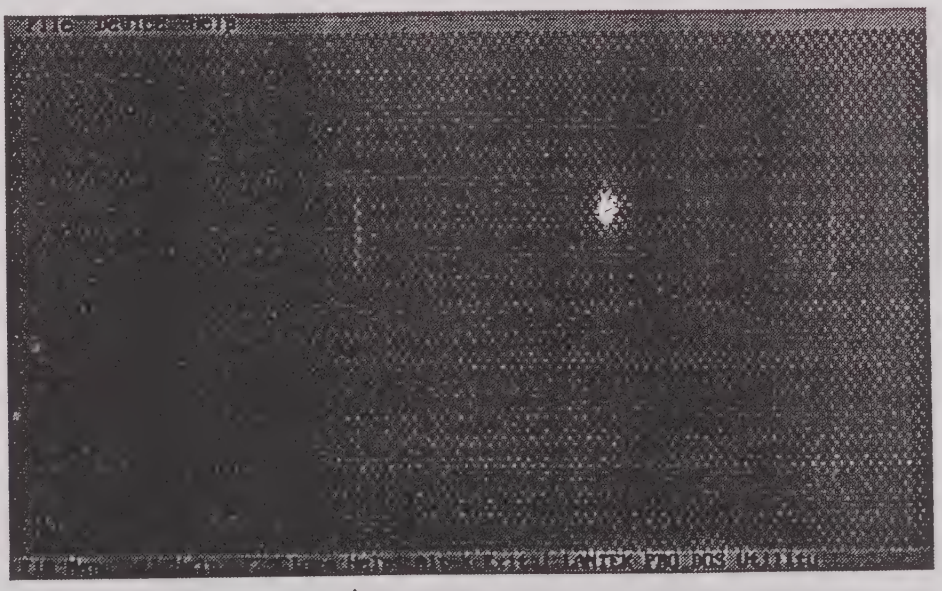
- Collateral upgrades required to other software for interoperability
- Changes affected by the upgrade

LANTEK PRO/PRO XL upgrades all include an MS-DOS application called LANTKDOS.EXE for performing the upgrades to the Display and Remote Handsets.
When the zip file is expanded the LANTKDOS.EXE file will be available.

Instrument Upgrading Steps

CAUTION: UPGRADING THE DISPLAY HANDSET WILL ERASE ALL STORED TEST RESULTS. BE SURE THESE TESTS HAVE BEEN SAVED OR PRINTED PRIOR TO PERFORMING THE FOLLOWING STEPS.

1. To start the upgrade run LANTKDOS.EXE and the application will open to an upgrade screen.



2. You may now use either a mouse or the ALT+__ key functions to open the menu items.

3. Open DEVICE then COM Port Setup to select the COM1 or COM2 for instrument control and set the BAUD Rate to 9600.

4. Connect the Display Handset to either COM1 or COM2 using the PRO Serial Kit cable and the 25 pin adapter (if required). Some PCs also require a 25 pin connection gender adapter. These are available at local computer stores.

5. Turn on the Display Handset and ensure there is sufficient battery power for 10 minutes of operation. If the battery power is too low, and the unit powers down before the upgrade is complete, the unit must be returned to the factory for corrective action.

6. Press the SETUP key, then **4- Printer** and Serial Port and make the following settings:

Baud Rate:	9600
Comm Mode	DTE
Remote Control	ON
Printer Type:	Epson or ASCII

Press ENTER to save and exit the Printer and Serial Port screen, the ESCAPE to go to the READY Screen.

7. At the PC, select DEVICE, then Upgrade Near-End. LANTKDOS will take control of the Display Handset, perform the upgrade, and advise you upon completion of a successful upgrade.

8. Remove the Display Handset and attach the Remote Handset to perform its upgrade. Like the Display Handset, ensure the battery has sufficient power to perform for 10 minutes or the upgrade may fail.
Note: The README.1ST file may contain information concerning the upgrade when the Remote Handset does not require an upgrade in conjunction with the Display Handset.

9. At the PC, select DEVICE, then highlight Upgrade Far-End, but DO NOT select it until after step 10.

10. At the Remote Handset, press and hold for about 5 seconds the Self Test button. The unit will beep and remain powered on for 12 seconds.

11. At the PC, press ENTER to select Upgrade Far-End. Once the LANTKDOS has control of the Remote Handset it will remain powered up throughout the upgrade.

When the upgrades are completed, select FILE, then EXIT to close LANTKDOS.

2 Using Setup

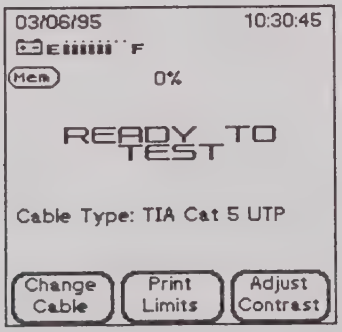
Setting & Customizing Cable Types

Select the cable type to be tested or customize the test parameters for cable propagation rate, frequency range, connector pinouts, and failure limits.

The Setup menu is used to change default settings for all test parameters and functions such as printing, downloading, power-off delay, time and date records, etc.

When a cable type is selected, the recommended limits for that cable are automatically programmed into the LANTEK PRO. These specifications can be changed for a particular requirement or custom test parameters can be set to accommodate special requirements.

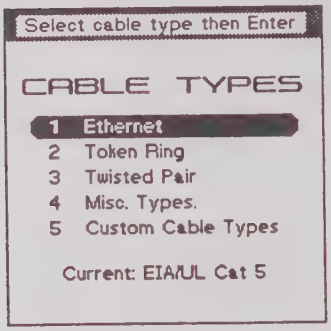
Cable Type can be selected or changed by using the **Setup** key to access the full Setup menu or a shortcut method is to use the **Cable** option key **(F1)** available from the Ready screen.



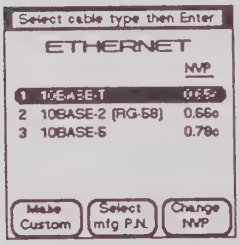
When using the **Setup** key to access the cable change menu, use the **Number 1** key, or press **Enter** to select "Select Cable Type."

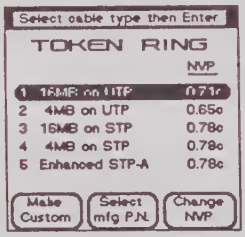
Both the **Cable** option key in the Ready screen and the **Number 1** key in the Setup menu will access the Cable Type menu.

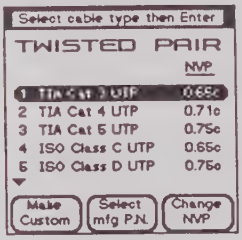
Use the **Number** keys to select or **Arrow** keys to scroll to the desired cable type. Press **Enter** to select.

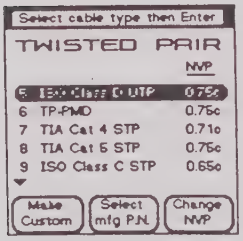


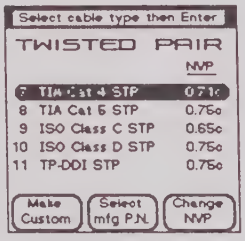
Cable choices are displayed by topology (type) and by manufacturer. Special cable types are listed under miscellaneous.

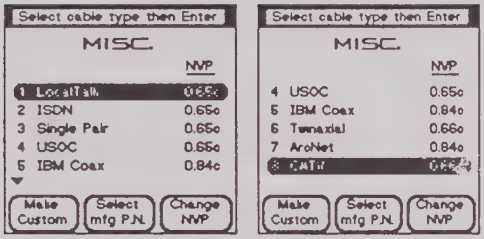





Select cable type then Enter
TWISTED PAIR
NVP
1 TIA Cat 3 UTP 0.65c
2 TIA Cat 4 UTP 0.71c
3 TIA Cat 5 UTP 0.75c
4 ISO Class C UTP 0.65c
5 ISO Class D UTP 0.75c
Make Custom
Select mfg P.N.
Change NVP







Use the **Number** keys to select or **Arrow** keys to scroll to the correct cable setting. Press **Enter** to select.

To check cable test parameters for the cable selected, press **Escape** to return to the Ready menu, then press **Print Limits**. The LANTEK PRO will print a list of cable parameters for the cable selected. Cable test parameters are also listed in Appendix B.

Each of the cable type menus offer option keys for **Make Custom (F1) , Select Mgf PN (F2)** and **Change NVP (F3)**, which allow you to change default values.

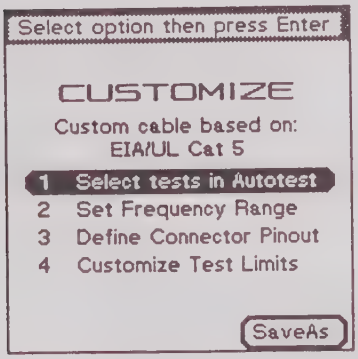
Press **Change NVP (F3)** to access an input box that displays the current default for the cable selected. Use the **Increase (F1)** or **Decrease (F3)** option keys to change the NVP or use the **Measure NVP** function if you have a sample of your selected cable type at known length. Press **Enter** to activate and return to the Select Cable Type menu.

Make Custom (F1) accesses a menu that allows you to select tests in Autotest, set the frequency range, define the connector pinouts, and customize test limits for the cable selected. The selected cable is displayed at the top of the menu box.

Select Mfg PN (F2) allows you to select a specific manufacturer's cable. After making custom changes, press **Enter** to return to the setup menu.

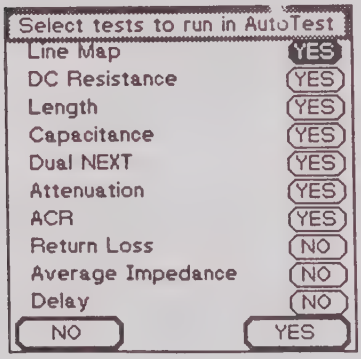
Customizing Test Setups
Not all installations require the full suite of tests included in Autotest. This menu allows the user to customize the test suite for Autotest as well as test parameters such as frequency range and failure limits for the cable type under test.

To customize test setups, press the **Make Custom** option key **(F1)**.



Use the **Number** keys to select or **Arrow** keys to scroll to the parameter to be changed. Press **Enter** to select.

(1) Select Tests in Autotest

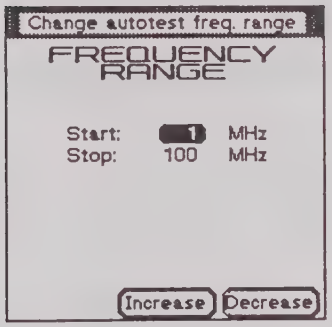


The default values will be displayed as shown above. Use the **Arrow** keys to scroll through the test list.

Press the **Yes** option key **(F3)** to include a test in Autotest, press **No (F1)** to remove it.

Press **Enter** when finished to activate selection and return to the Customize menu.

(2) Set Frequency Range

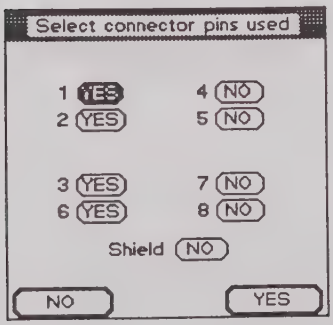


minimum test frequency = 1MHz

maximum test frequency = 100MHz

The default values will be displayed as shown above. Use the **Arrow** keys to select Start or Stop. Press the **Decrease (F3)** or **Increase (F2)** option keys to make changes. Press **Enter** when finished to activate selection and return to the Customize menu.

(3) Define Connector Pinout

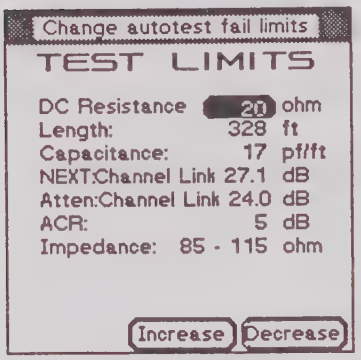


The default connector pinout arrangement will be displayed as shown above. Use the **Arrow** keys to scroll through the pinout connections. Press the **Yes** option key **(F3)** to select a pin combination or the shield, **No (F1)** to remove it.

Notice that pins are grouped in pairs. If one wire in a pair is not selected, tests for NEXT, attenuation capacitance,

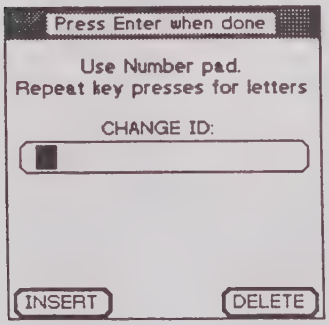
DC resistance and impedance will not be performed on that pair.

(4) Customize Test Limits



Use the Test Limits screen to customize Autotest pass/fail limits. Use the **Arrow** keys to scroll to a field, then press the **Increase (F2)** or **Decrease (F3)** key to change the value.

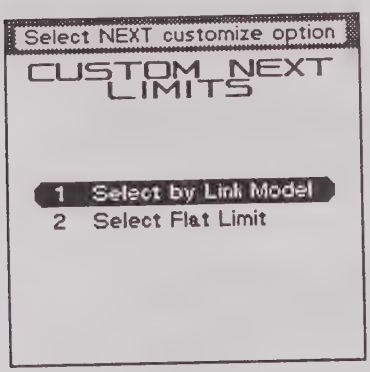
After making custom changes, press **Enter** to return to the Customize menu. Press the **SaveAs (F3)** key to name the customized test and store it. A name screen will be displayed.



Use the **Alphanumeric** keys to enter up to 13 numbers or letters to name the customized test. Press **Enter** when finished to store the the custom test setup and exit.

Customizing NEXT, Attenuation and Impedance
When the NEXT, attenuation or impedance parameters are selected in the Custom Test Limits menu, a **Change (F3)**

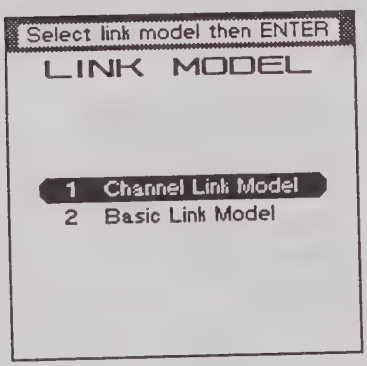
option key appears to access the custom NEXT, attenuation and impedance limit screens.



Custom NEXT limits can be set using the link model or by specifying a flat limit.

Use the **Arrow** keys to select "Link Model or Flat Limit."

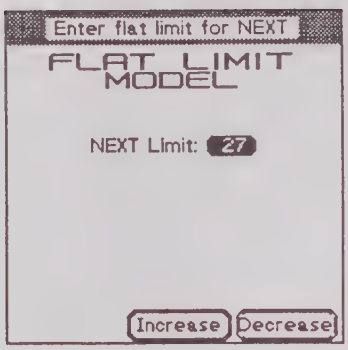
Press the **Enter** key.



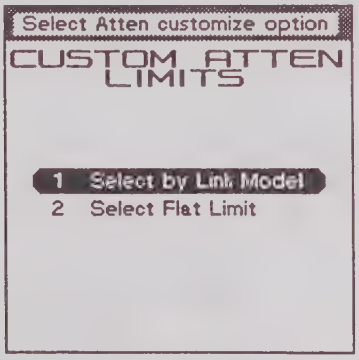
In the NEXT Link Model menu screen, press the **Number 1** or **2** key to select "Channel" or "Basic" link model.

Press **Enter** to select.

Press **Escape** to return to the Custom NEXT Limits menu.



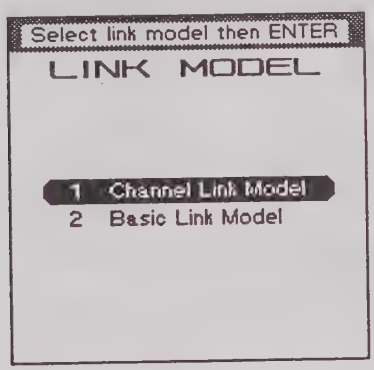
In the NEXT Flat Limit menu screen, use the **Increase (F2)** or **Decrease (F3)** option key to change the NEXT flat limit to a value that is higher or lower.



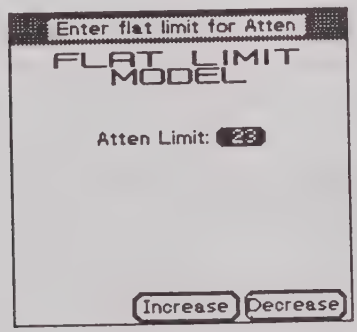
In the Custom Attenuation Limit menu screen, use the **Number** keys to select or **Arrow** keys to scroll to "Link Model" or "Flat Limit."

Press **Enter to select.**

In the Attenuation Link Model menu screen, use the **Number 1** or **2** key to select "Channel Link Model" or "Basic Link Model." Press **Enter** to select and return to the Custom Attenuation Limits menu.



In the Attenuation Flat Limit menu screen, use the **Increase (F2)** or **Decrease (F3)** option key to change the attenuation flat limit.



In the Impedance menu screen, use the **Increase (F2)** or **Decrease (F3)** option key to change the minimum and maximum limits for impedance.

Press **Escape** to return to the Customize menu.

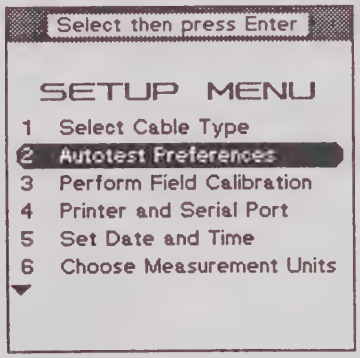
Setting Autotest Preferences

Allows you to set automatic save or print; change automatic increment for test ID.

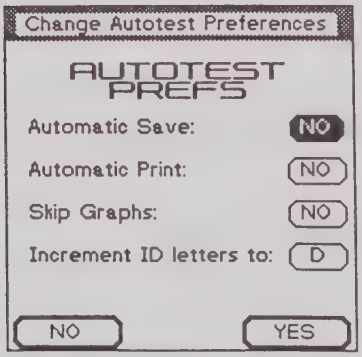
Autotest can be set to automatically save and/or print test results at the completion of each suite of tests. Results will be automatically named in sequence.

> Only passed Autotests will AutoSave and AutoPrint. AutoSave and AutoPrint will stop at the end of an Autotest if the test fails.

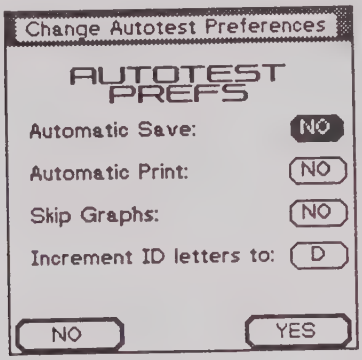
To customize Autotest or other test parameters, press the **Setup** key to display the Setup menu.



Use the **Number** 2 key to select or **Arrow** keys to scroll to "Autotest Preferences." Press **Enter** to select.



Set Autotest Preferences - Use the **Arrow** keys to scroll to the automatic feature you want to change. Press the **Yes** key **(F3)** to add the feature; press the **No** key **(F1)** to eliminate the feature.

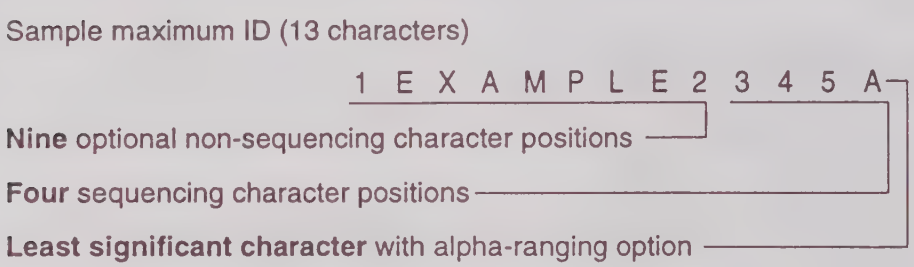


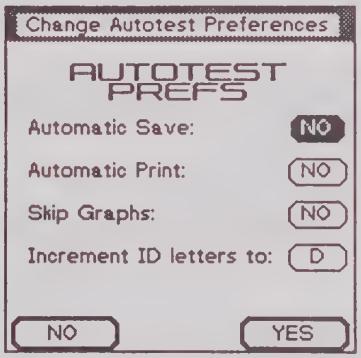
Each Autotest result is automatically given the next default ID in a sequence. The sequence increments, the least significant digit/character by one, based on the last ID used.
When the test results are displayed at the end of a test, the ID appears on screen and can be used by pressing **Save** or **Print,** or changed by pressing **SaveAs.**

The number of characters in a test ID can be 1 to 13. The characters that automatically increment are the four least significant positions. If all four positions are numbers, they will increment the same as an odometer (0-9). If a letter character is in any of the positions it will increment from A to Z. If a letter character is chosen for the far right character, that letter sequence can run from A to Z or be limited to any character in the alphabet. As an example, you choose to stop the sequence at the letter D, the ID sequencing will increment as follows:

000A, 000B, 000C, 000D, 001A, 001B . . .999D maximum

The nine most significant character positions can be numbers, letters or any of the special characters available through cycling the **0 <space>** key.


Sample maximum ID (13 characters)
1 E X A M P L E 2 3 4 5 A
Nine optional non-sequencing character positions
Four sequencing character positions
Least significant character with alpha-ranging option



Press **Enter** to exit the Autotest Preferences menu screen.

Performing Field Calibration

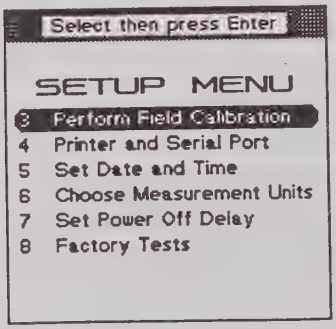
Perform once each day to ensure the highest accuracy in measurement.

It is recommended that the LANTEK PRO be calibrated once each day to ensure the highest accuracy in measurement and peak operational performance.

The field calibration can be performed using either the DB15-to-DB15 adapter alone or using both the DB15-to-DB15 and the coax adapter. The coax adapter alone can NOT be used to successfully calibrate.

If coax cable is going to be tested, select the coaxial cable type before performing the calibration or it will be omitted from the calibration even if the coax adapter is connected.

To perform a field calibration, press the **Setup** key to display the Setup menu.

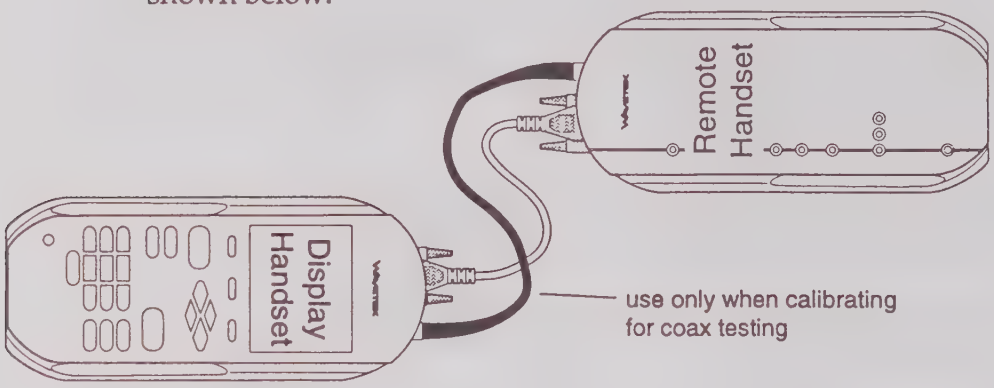

Select then press Enter
SETUP MENU
3 Perform Field Calibration
4 Printer and Serial Port
5 Set Date and Time
6 Choose Measurement Units
7 Set Power Off Delay
8 Factory Tests

Use the **Number 3** key to select or **Arrow** keys to scroll to "Perform Field Calibration," and press **Enter**.

Press ESC to leave screen
FIELD CALIBRATION
1 Connect display and remote handset unit using cable
2 Press Start
Note: calibration may take up to 60 seconds
START

Connect the display unit to the remote unit as shown below, using the DB15 and/or coax calibration connectors provided with your LANTEK PRO.

If you will be testing twisted pair cable only, it is not necessary to connect the coax calibration connectors. The LANTEK PRO will automatically calibrate for twisted pair only. If you are testing coax cables, connect both adapters as shown below.



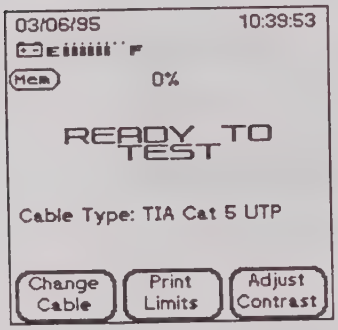
Press **Start** to begin calibration.

The LANTEK PRO will self calibrate and return to the Ready screen when completed. When calibration is completed, the LANTEK PRO will display a message advising whether calibration was successful or problems were detected. If you receive an alert message indicating a calibration failed, check the "Unsuccessful Field Calibration Correction" list on page 1-16 to correct the problem. You can also contact a Wavetek service facility or sales office. See Chapter 7: Customer Service & Warranty for instructions.

Using Custom Cable Settings

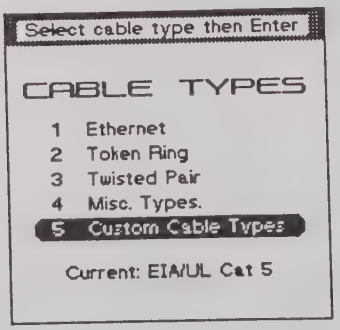
Allows you to recall a stored custom test setup by name.

Customized cable settings that you have programmed and stored can be retrieved when you need them. To recall a setup for use, press the **Cable (F1)** option key available at the Ready screen or press the **Setup** key.

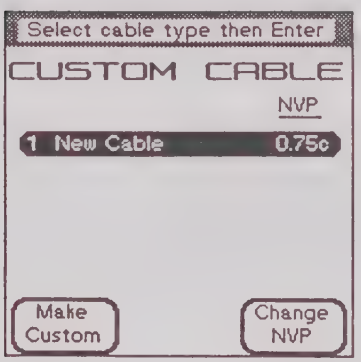


Use the **Number 5** key to select or **Arrow** keys to scroll to "Custom Cable Types"if using the **Cable** option key. Press **Enter** to select.

If using the **Setup** key, press the **Number 1** key to select "Select Cable Type" then use the **Number 5** key to select or Arrow keys to scroll to "Custom Cable Types."



The unit will display custom cable types that you have previously created or allow you to create a new custom cable type based on the current cable type displayed.



template for making custom cables

Although the **New Cable** template can be used to create a completely customized cable type, it is usually more efficient to select the closest standard cable type and then use the **Make Custom** function key to create your custom cable type.

Use the **Number** keys to select or **Arrow** keys to scroll to the custom test setup you want to recall.

The unit will display a confirmation message that the setup has been recalled and then return to the Setup menu.

Press **Escape** to exit the Setup menu.

The LANTEK PRO is now ready to test using the stored setting.

Setting Printer/Serial Port Configuration

Allows you to set configurations for the serial port and printer.

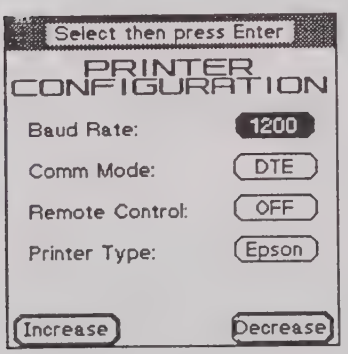
The Printer/Serial Port Configuration menu allows you to configure the serial port and select the type of printer being used. To access the Serial Port Configuration menu, press the **Setup** key to display the Setup menu.

Select then press Enter
SETUP MENU
3 Perform Field Calibration
4 Printer and Serial Port
5 Set Date and Time
6 Choose Measurement Units
7 Set Power Off Delay
8 Factory Tests

Setup Menu

Use the **Number 4** key to select or **Arrow** keys to scroll to "Printer and Serial Port."

Press **Enter** to select.



Use the **Number** keys to select or **Arrow** keys to scroll to the setting you want to change. Press **Enter** to select.

(1) Baud Rate

To change baud rate, use the **Increase** or **Decrease** option keys. Baud rate can be selected from 300 to 38400.

(2) Comm Mode

To change the comm mode, press the **DTE (F1)** or **DCE (F3)** option key. Most printers require the mode set to DTE; verify the setting required by your printer. For computer connection DTE is mainly used; verify the setting required by your computer. The LANTEK PRO's portable printer PTR-1LT, requires a DCE setting.

(3) Remote Control

Press **On** or **Off** to enable or disable. Remote should be set to On when controlling the LANTEK PRO or LANTEK PRO XL through the serial port (PC remote operations). The serial port will automatically be activated when printing even if ON is selected.

(4) Printer Type

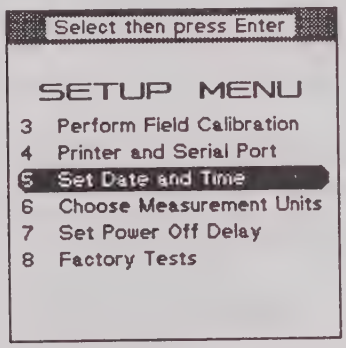
To select either Epson or ASCII character set, press either **Epson (F1)** or **ASCII (F3)**.

If you are using an ASCII only printer, graphs will not be printed, and a form feed will be output after every test report.

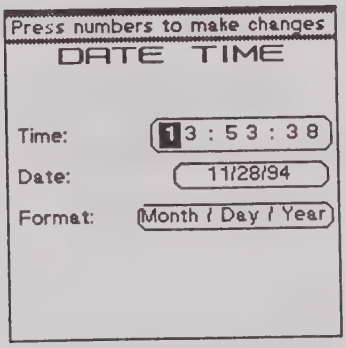
Changing the Date and Time

Date and time settings provide important report record information.

Accurate date and time settings are essential for report records. Date and time are displayed on the Ready screen on startup. To change the date and time, press the **Setup** key to display the Setup menu.


Select then press Enter
SETUP MENU
3 Perform Field Calibration
4 Printer and Serial Port
5 Set Date and Time
6 Choose Measurement Units
7 Set Power Off Delay
8 Factory Tests

Use the **Number 5** key to select or **Arrow** keys to scroll to "Set Date and Time." Press **Enter** to select.

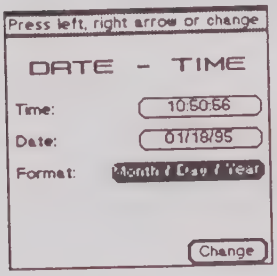


Use 24 hour clock entry to ensure the date changes after 23:59:59.

Inside a field the cursor will move right automatically after a character has been entered.

Use the **Alphanumeric** keys to change the date and time. Use **left/right Arrow** keys to move the cursor inside the field and **up/down Arrow** keys to change fields.

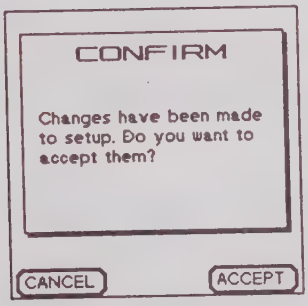
Day, month, and year can be displayed nine ways:



Month / Day / Year
Day / Month / Year
Day - Month - Year
Day - Month
Month / Year
Year / Month / Day
Month / Year / Day
Day / Year / Month
Year / Day / Month

To change the format, press the **Change (F3)** option key. Repeat pressing **(F2)** to toggle to the preferred setting in the list shown above.

Press **Enter** to initiate the changed date and time settings and return to the Setup menu. The unit will display a confirmation message to accept or cancel the changed settings.



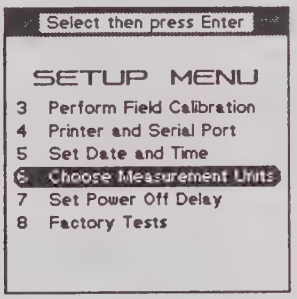
Press **Accept** to confirm changes and return to the Setup menu.

Selecting Units of Measurement

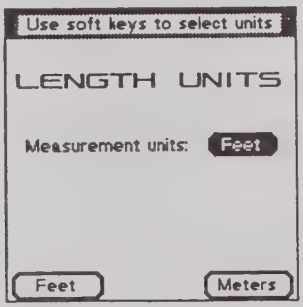
Set unit of measurement to US or metric for your requirements.

Unit of measurement is important for length measurement and correct readings for test parameters based on length. The default setting is "feet." Make sure the appropriate unit of measurement for your testing requirements is set.

To verify or change the unit of measurement, press the **Setup** key to access the Setup menu.


Select then press Enter
SETUP MENU
3 Perform Field Calibration
4 Printer and Serial Port
5 Set Date and Time
6 Choose Measurement Units
7 Set Power Off Delay
8 Factory Tests

Use the **Number 6** key to select or **Arrow** keys to scroll to "Select Measurement Units." Press **Enter** to select.



Use the **F1** or **F3** key to select "feet" or "meters." The unit will display a confirmation of the new unit of measurement and return to the Setup menu.

Setting Power-Off Delay

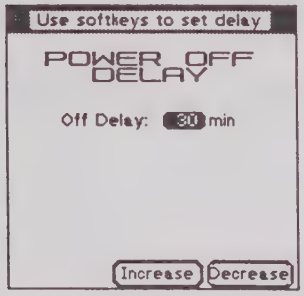
Power-off conserves battery power when the LANTEK PRO is not in use.

The LANTEK PRO is programmed to automatically power down when not in use to conserve battery power. The default setting is a 30 minute delay after the last key press. Power-off can be disabled by selecting a setting of 99 minutes.

To change the power-off delay, press the **Setup** key to display the Setup menu.

Select then press Enter
SETUP MENU
3 Perform Field Calibration
4 Printer and Serial Port
5 Set Date and Time
6 Choose Measurement Units
7 Set Power Off Delay
8 Factory Tests

Use the **Number 7** key to select or **Arrow** keys to scroll to "Set Power Off Delay." Press **Enter** to select.



Use the **Increase (F2) or Decrease (F3)** option key to change the power-off delay.

Press **Enter** to activate and return to the Setup menu.

System Information & Factory Tests

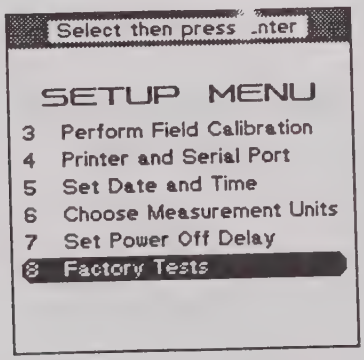
Accesses system information and Wavetek's service facility diagnostic program.

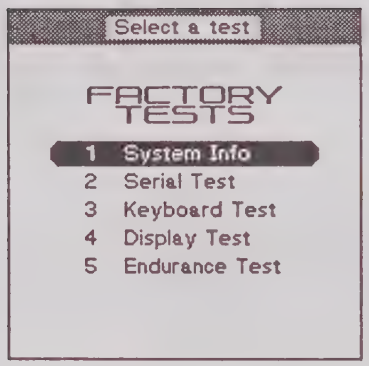
The Factory Tests menu accesses system information about the LANTEK PRO unit you have and factory test procedures. System information includes version number, latest factory calibration date, number of saved tests and memory utilized. Access anytime for status on utilized memory and last calibration.

Testing keys should only be used by a Wavetek authorized service center or under direction of a Wavetek product advisor.

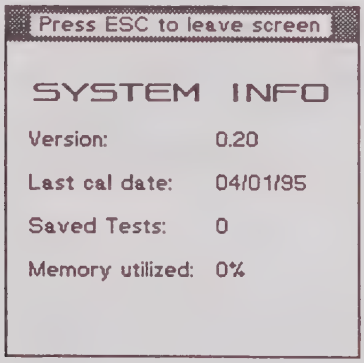
To access system information press **Setup**. Use the **Number 8** key to select or **Arrow** keys to scroll to "Factory Tests."

Press **Enter**.


Select then press nter
SETUP MENU
3 Perform Field Calibration
4 Printer and Serial Port
5 Set Date and Time
6 Choose Measurement Units
7 Set Power Off Delay
8 Factory Tests



To view system information, press **Enter** while the highlighter is on "System Information."

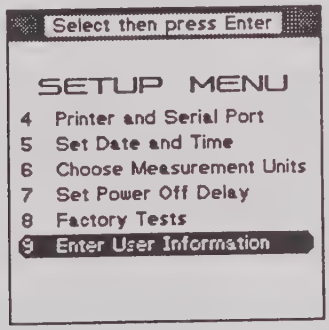


Press **Escape** to return to the Factory Tests menu. Press **Escape** again to return to the Setup menu.

User Information

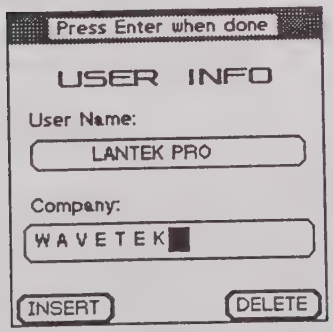
Use this information box to record user and company name for test reports.

User information should be entered to identify the unit operator for test reports. To enter user information, press the **Setup** key to display the Setup menu.


Select then press Enter
SETUP MENU
4 Printer and Serial Port
5 Set Date and Time
6 Choose Measurement Units
7 Set Power Off Delay
8 Factory Tests
9 Enter User Information

Use the **Number 9** key to select or **Arrow** keys to scroll to "Enter User Information."

Press **Enter** to select.



Use the **Alphanumeric** keys to enter user name and company name. Use the **Arrow** keys to move from one field to the next.

Press **Enter** to return to the Setup menu when finished entering user information.

3 Using Autotest

Running Autotest

Performs comprehensive tests to measure cabling using programmed testing limits. An overall pass or fail is displayed along with individual test results.

Autotest is the easiest and quickest way to measure and verify your cabling installation. Simply press the Autotest key and the LANTEK PRO automatically performs the suite of necessary tests – in approximately 30 seconds – and displays an overall pass/fail result and individual test results.

Autotest performs these individual tests:

- Line map
- DC loop resistance
- Length
- Mutual capacitance
- Attenuation
- Dual NEXT
- Attenuation to crosstalk ratio (ACR)
- Average Impedance
- Delay
- Return loss

The selection of cable type determines the default test included in an Autotest, and custom cable types allow manual selection of included tests. Autotest can be preset to automatically print and save test results immediately following each suite of tests or results can be printed and saved manually. To preset these functions, see Chapter 2 section: "Setting Autotest Preferences."

Individual sub-tests can be selected and viewed with more detailed data following completion of the Autotest using the Autotest results screen.

> Perform **Field Calibration** at least once per day prior to testing.

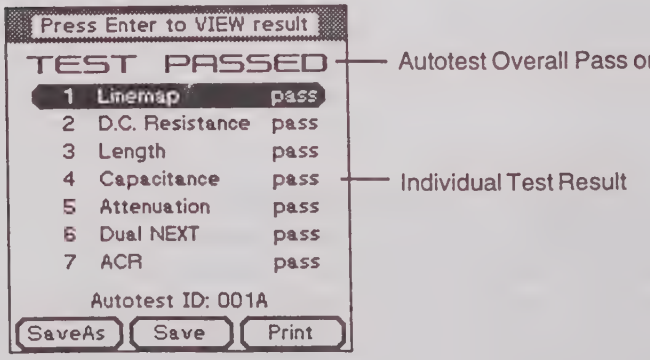
To begin testing, connect the LANTEK PRO display and remote handsets to the cable or link to be tested as instructed in Chapter 1. Press the **Autotest** key.

Autotest automatically compares the cable test readings to standards for the cable type selected and issues a pass/fail statement. Custom test parameter settings can also be selected using the Setup menu. For instructions, see Chapter 2 section: "Customizing Test Setups."

> Press and hold **Escape** prior to Autotest completion aborts the test sequence at the end of the test in progress.

While Autotest is in progress, a bar graph displays test progress and indicates pass or fail for each completed test.

When the Autotest is completed, an overall result of pass or fail is displayed at the top of the test information columns. Results for individual tests are displayed opposite each test.



Individual Test Results

The results of individual tests may be reported as follows:

pass - all values of the individual test pass with sufficient margin.

pass* - all values pass, but one or more test values passes by a margin smaller than the unit's specified accuracy for the measurement.
fail* - one or more values fail, but the margin of failure is smaller than the unit's specified accuracy for the measurement.
fail - one or more values fail by significant margin.

The overall Autotest result is a "pass" if each individual test is a "pass" or a "pass*." The overall Autotest result is a "fail" if one or more individual test is either a "fail" or a "fail*."

This is the same result, overall, as before the pass*/fail* concept was introduced.

The effect of the pass*/fail* reporting of individual test results is to make a "guard band" above and below the limit for a measurement which is equal to the advertized accuracy of making that measurement. Measurements which fall outside the guard band are a clear "pass" or a clear "fail," and the probability of the LANTEK being in error is negligibly small. The "pass*" result means that the probability that the LANTEK is erroneously passing a marginally bad cable is no longer negligible. The "fail*" result means that the probability that the LANTEK is erroneously failing a marginally good cable is no longer negligible.

The "pass*" result does not fail the cable. However, it is a warning that the cable is close to the limit on that parameter and it should be inspected to make sure that there is no obvious and simple improvement which could be made to result in a clear pass.

The "fail*" result fails the cable and this must be cleared up, just like a "fail." However, the "fail*" means it has failed by a small margin and there is nothing major wrong with the installation, and possibly "tightening up" on the workmanship will get the cable run to pass.

Results can be viewed in detail using the instructions that follow on page 3-5.

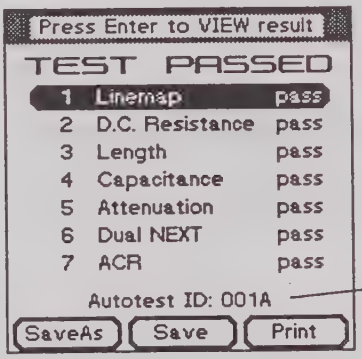
To begin the next test, press **Autotest**. If results have not been printed or saved, you will be prompted to do so or discard results before the next Autotest will run.

The LANTEK PRO also performs Fault Find, a diagnostic program that provides dynamic, real time testing that enables the user to troubleshoot problem areas. If Autotest test results indicate a failure, see Chapter 4 to use Fault Find.

Viewing Autotest Results

Individual test results can be viewed at the completion of the Autotest or later using the Test Results menu.

At the completion of Autotest, overall pass/fail results are displayed, along with individual results for each test. Detailed results for individual sub-tests can be viewed by making a selection from the Autotest results screen and pressing the **Enter** key



Autotest results can be viewed at the completion of the test sequence or saved and viewed later. However, table information is saved only, graphs are not saved. To retain a permanent copy of graph information, call up the graph on the LCD and print out the results.

To view results while in the Autotest menu, use the **Number** keys to select or **Arrow** keys to scroll to the sub-test result you want to view.

Press **Enter** to view results.

To save results and view later, press the **Save (F2)** or **SaveAs (F3)** option key while in the Autotest results screen. Autotest results are automatically named in sequence.

The test ID name is displayed at the bottom of the screen. See Chapter 2 section: "Setting Autotest Preferences" to change the automatic sequence.

SaveAs allows the test to be renamed. Press this key if you want to save the test with a different name. After completion of the SaveAs operation, control returns to this screen with the new test name displayed. This action resets the ID sequence to the new name.

Save stores the test using the name displayed as Test ID. After completion of the save operation, control returns to the screen.

In Autotest, results for the entire suite of tests are printed or saved as one file.

Graph information is not saved in Autotest (to increase the number of tests that can be saved). If you need to provide graphic information, print graphs before leaving Autotest.

Press **Escape** to exit an individual test result screen and return to the Autotest results menu.

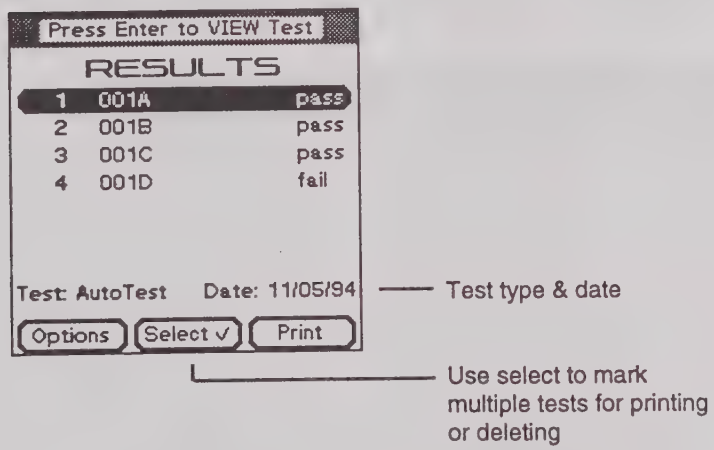
Press **Escape** again to exit the Autotest results screen or **Autotest** to run another test. If test results have not been printed or saved, a prompt will ask if you want to do so before exiting.

Viewing Saved Test Results

Test Results contains stored data from Autotest and Fault Find. Up to 500 Autotests can be stored in memory. Users can view, print, delete or rename these files at their convenience.

When an Autotest or an individual test from Fault Find is saved, the data is stored with a unique name. A list of these file names is displayed when the **Test Results** key is pressed. Tests can be viewed, printed, deleted, or renamed.

To view test results that have been saved, press the **Test Results** key.



Use the **Number** keys to select or **Arrow** keys to scroll to the test you want to view.

To scroll faster through a large list of test results, hold down the **Arrow** key for longer than 2 seconds. This accelerates the scroll rate.

The type of test and date of performance is displayed for the highlighted test at the bottom of the screen.

Press the **Enter** key to view test results.

Press **Escape** to return to the Test Results menu. Press **Escape** again to exit the Test Results menu and return to the Ready screen.

Printing Autotest Results

Printing can be done from the Autotest results screen or later from stored results (except graphs). The LANTEK PRO must be connected to a printer with a serial port (RS-232).

Autotest results can be printed immediately following each suite of tests using either the autoprint feature or manually using the **Print** option key **(F3)** in the Autotest results screen and individual test results screens.

Results can also be printed later from the Test Results menu if the results have been saved, however, graph information is not stored and cannot be printed later.

To print results, first verify the printer is connected to the LANTEK PRO serial port and the printer is powered up. The LANTEK PRO companion printer PTR-1LT should be set at:

XON/XOFF
Baud rate: 9600
Data bits: 8
Start/Stop bit: 1
No parity

The LANTEK PRO serial configuration should be set at:
Baud rate: 9600
Comm mode: DCE
Remote control: On or Off (Off conserves power!)
Printer type: Set to Epson for PTR-1LT Printer

Press the **Print** option key.

Settings for other printers may vary. Consult the operator's manual for your specific printer.

For most serial printers (other than the PTR-1LT), ensure the following steps are completed:

(1) Connect the printer's DB-25 serial port and the LANTEK PRO/LANTEK PRO XL's DB-9 serial port using the PRO-SERIAL-KIT cable and adapter supplied with the unit.

(2) Check the printer's setups for the following communications settings:

a. Serial Communications
b. Baud Rate = 9600
c. Protocol = XON/XOFF or CTS / RTS
d. Start/Stop Bit = 1
e. Parity = None
f. Data Bits = 8
g. Character Set = Epson (required for graphs to print) or ASCII

Most serial printers use **DTE** (Data Terminal Equipment) signalling, but some, like Wavetek's PTR-1LT use **DCE** (Data Communications Equipment) signalling. The PRO-SERIAL-KIT cable and adapters will work with either and the DCE or DTE signalling can be changed in the LANTEK PRO / LANTEK PRO XL setups.

(3) At the Display Handset press the **SETUP** key and select **4. Printer and Serial Port**. Use this menu's settings to make change as follows:

a. Use the **Increase (F1)** or **Decrease (F3)** option key to change the Baud Rate. Baud Rate must match the printer or PC port's Baud Rate for correct communications. The default setting is 9600 and the full selection range is 300 to 38400.

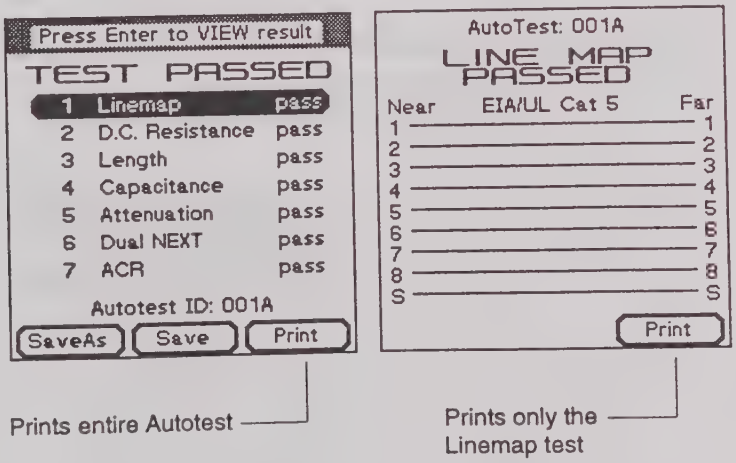
b. Use the **up/down arrow** keys to move between selections.

c. Use **(F1)** and **(F3)** keys to toggle between **DCE** and **DTE** Comm Modes. Use **DCE** for PTR-1LT serial printer. Use **DTE** for most serial printers and for PC serial port communications.

d. Use **(F1)** and **(F3)** keys to toggle between Remote Control **ON** or **OFF**. **OFF** conserves power for longer battery life. **ON** is required only when using a PC and uploading test results or upgrading the unit using Wavetek's PRO Utilities, CMS or other remote control software.

e. Use **(F1)** and **(F3)** keys to toggle between **Epson** and **ASCII** Character Sets.

Settings which are hard set in the LANTEK PRO / LANTEK PRO XL and can not be altered are: Parity Bit = Off, Start Stop Bit = 1 and Data Bits = 8. The LANTEK PRO /LANTEK PRO XL's serial port will automatically respond to either XON/ XOFF or CTS signalling. Most printers and PCs provide settings which can match these parameters.



Although tests can be printed from the Test Results menu, graphs are not saved when the Autotest menu is exited and cannot be printed later.

(3) When an Autotest has been run, either all the results or individual test results can be printed.

a. To print the complete Autotest results press **(F3) PRINT**. The LCD will indicate that the printing is in progress and return to the Autotest's results screen.

b. To print only one Autotest parameter result (e.g., Line Map) select the desired test using the cursor, press **ENTER** and press the corresponding number key. Pressing the **(F3) PRINT** key now will print only the Line Map test.

c. To print more than one test, refer to section on Printing Fault Find Results, Group Test Selection, in Chapter 5.

d. To print graphics from the Autotest results select either **5. Attenuation** or **6. Dual NEXT** as desired. When the list of test results appears, select a pair (or pair combination for NEXT) and press **ENTER**. When the graph(s) appear press **(F3) PRINT**.

Saving Autotest Results

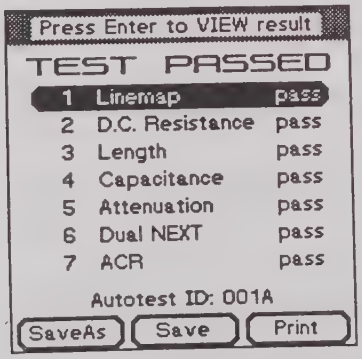
Up to 500 Autotest test results can be stored in memory and accessed later using the Test Results menu.

Autotest results can be saved immediately following the test using the Autotest results screen or by enabling the **AutoSave** option in the Autotest preferences Setup menu.

To save results immediately following the Autotest, press either the **Save (F2)** or **SaveAs (F1)** option key.

SaveAs allows the test to be renamed. Press this key if you want to save the test with a different name. After completion of the SaveAs operation, control returns to this screen with the new test name displayed.

Save stores the test using the name displayed as Test ID. After completion of the Save operation, control returns to the Autotest Summary screen, shown below.

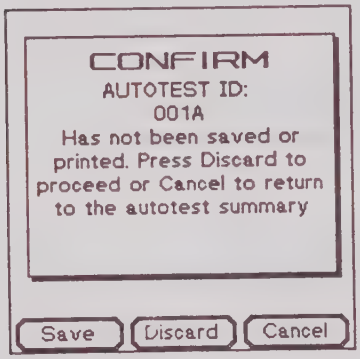


In Autotest, results for the entire battery of tests are printed or saved as one file.

Graph information is not saved in Autotest (to reduce memory use). If you need to provide graphic information, print graphs before leaving Autotest or use the Fault Find Save function to capture graphs.

The LANTEK PRO automatically names each test in sequence based on the increments selected in the Autotest setup menu. The default increment is "D" or four tests per sequence. Using the default, the tests will be labeled as 001A, 001B, 001C, 001D, 002A, 002B, 002B, 002D, etc. To change the test sequence before testing, see Chapter 2: Setting Autotest Preferences.

Press **Escape** to exit the Autotest results menu. If the test results have not been saved, a prompt message will appear and allow you to save or print test results.



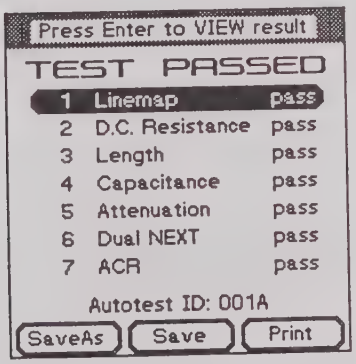
To view saved test results after exiting the Autotest menus, see Chapter 5 section: "Viewing Test Results."

Naming Autotest Results

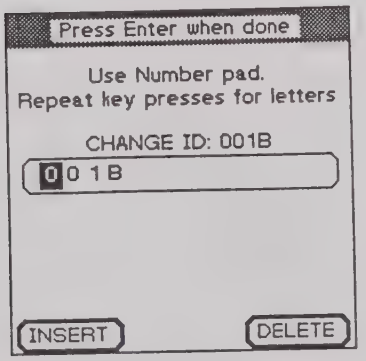
Tests are automatically named in sequence when the Save option key is used or can be named manually using the SaveAs option key.

Autotest results are automatically named in sequence if the **Save** option key is used or AutoSave is enabled. The test name is displayed at the bottom of the screen. If a different name is desired, a test can also be named manually using the **SaveAs** option key.

To save results immediately following the Autotest, press either the **Save (F2)** or **SaveAs (F1)** option key.



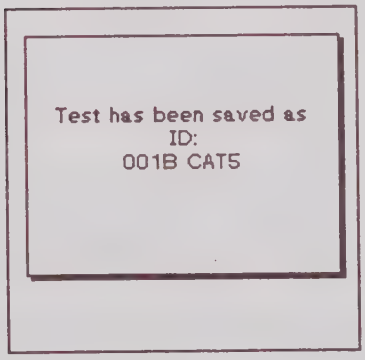
If **SaveAs** is selected, the unit will display a name change screen.



Use the **Alphanumeric** keys to enter your selection for number and letter changes. Any combination of thirteen letters and numbers may be chosen. The insert and delete keys may be used to add spaces or shorten the file name.

The **Arrow** keys can be used to move to the next character position or after three seconds, the cursor will move automatically one position to the right and wait for the letter or number input.

When the name change is completed, the unit will display a confirmation screen that returns to the Test Results screen automatically.



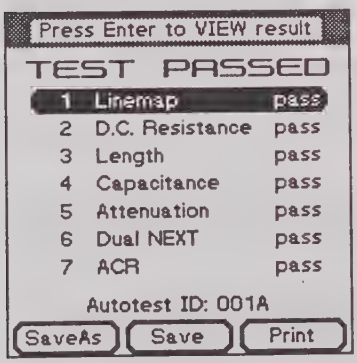
If you are using an ID sequence to save test results, the sequence will be re-set to the new ID entered in **SaveAs**.

Line Map

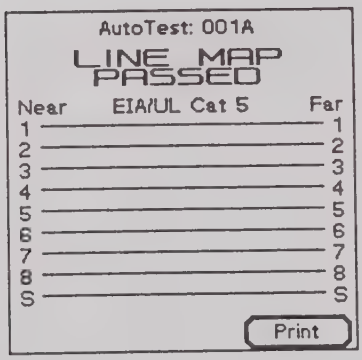
Test for pin-to-pin connectivity and shield continuity. Test results are displayed graphically for easy visual indication of any problems.

Line mapping, also referred to as end-to-end connectivity, verifies the integrity of individual wires in a twisted pair cable by using a coded signal to determine that the wires are connected correctly and there are no shorts or opens.

To view line map results from the Autotest results menu , use the **Number** 1 key or **Enter** to select "Line Map."



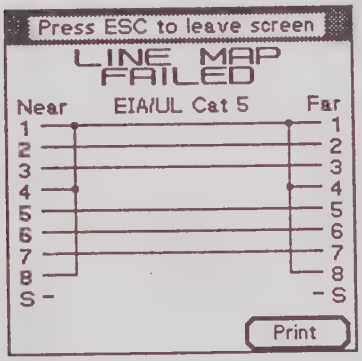
Press **Enter.**



The line map results screen displays up to 8 wires and one shield. The display will reflect wire patterns for other cable types, with fewer wires.

The graph above shows a typical passing line map. A properly wired cable has straight lines connecting the appropriate pins. A bad cable is displayed by crossed, unconnected or shorted connections.

Following is a sample line map that failed:



Wires that are misconnected are clearly shown. Wires that are not connected are displayed as a short line next to the pin number.

When the line map fails, the Fault Find feature in LANTEK PRO can be used to troubleshoot problems. See Chapter 6.

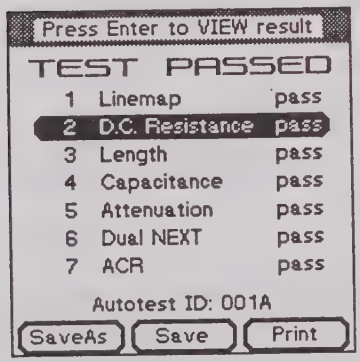
Press **Escape** to return to the Autotest menu.

DC Resistance

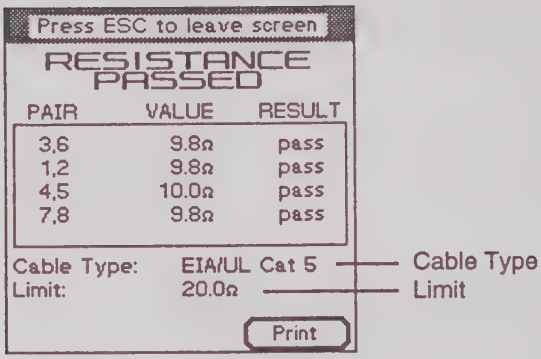
DC loop resistance is an effective check on cable and connector integrity. Both cabling and connectors have inherent DC resistance; the LANTEK PRO tests to make sure total resistance does not exceed recommended limits.

Autotest measures the loop resistance of each pair of wires. Loop resistance is the combined resistance of each individual wire in a two-wire pair. The LANTEK PRO compares measured values to maximum limits specified for the cable type setting or custom test limits you've selected. A typical Cat 5 100 meter cable will have total DC loop resistance of about 16 ohms.

To view DC loop resistance results from the Autotest menu, use the **Number 2** key to select or **Arrow** keys to scroll to "DC Resistance."



Press **Enter**.



Results are displayed with resistance in ohms for each pair and the comparison limit for the cable type. Pair resistance that exceeds the limit is indicated as a failure. A reading of "OVER" indicates resistance of more than 400 ohms. For LAN cable testing purposes this can be considered an open circuit.

Short cables have low loop resistance, while longer cables have more resistance, since the amount varies with length on a linear scale. The cable type and limit is displayed at the bottom of the screen.

To troubleshoot a failed resistance test, use Fault Find as instructed in Chapter 4.

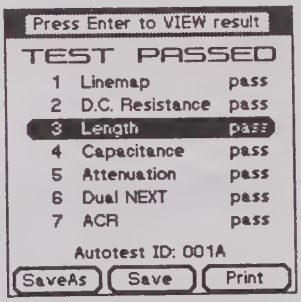
Press **Escape** to return to the Autotest menu.

Length

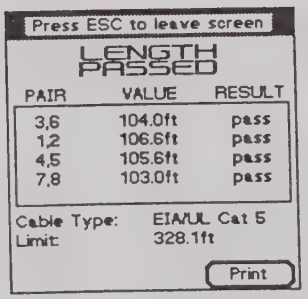
Length is determined using the time it takes for a transmitted signal to reflect back from the end of the cable. Measuring the length of the cable requires that the nominal velocity of propagation (NVP) of the cable be known.

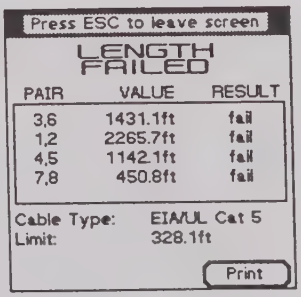
Autotest performs a length test for each pair to ensure recommended limits for the particular cable type are not exceeded. Length is reported in either feet or meters, depending on the units selected in the Setup menu.

To view length test results from the Autotest menu, use the **Number 3** key to select or **Arrow** keys to scroll to "Length."



Press **Enter**.





Length results are displayed for each pair, and the limit for cable type is displayed for comparison. Length may differ slightly between pairs in the same cable. This is due to minor

NVP differences between the pairs and physical length differences due to twisting patterns. A substantial difference in length, however, signifies a problem, such as a break or short in the pair.

To troubleshoot a failed length test, use Fault Find as instructed in Chapter 4.

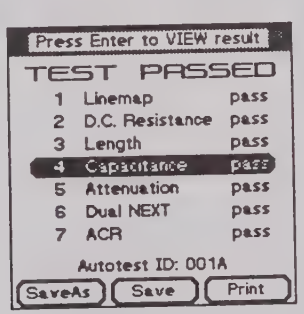
Press **Escape** to return to the Autotest menu.

Capacitance

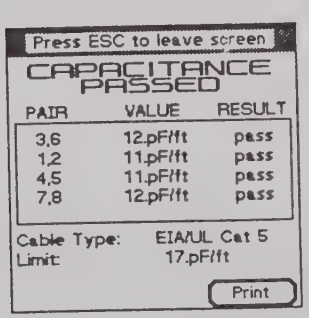
Excessive mutual capacitance between wires in a pair affects the quality of a signal.

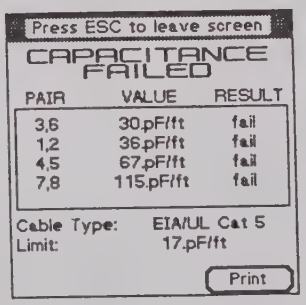
Autotest measures the mutual capacitance between the two conductors of each wire pair to verify that installation has not affected the capacitance for the particular cable type. Poor connections at punch downs and wall plates, as well as stretched cable, can cause abnormal mutual capacitance readings. In mutual capacitance testing, pair total capacitance is normalized to capacitance per feet (meters), and expressed in pF (picoFarads) per unit length (feet or meters).

To view capacitance results from the Autotest menu, use the **Number 4** key to select or **Arrow** keys to scroll to "Capacitance."



Press **Enter**.





To troubleshoot a failed mutual capacitance test, use Fault Find as instructed in Chapter 4.

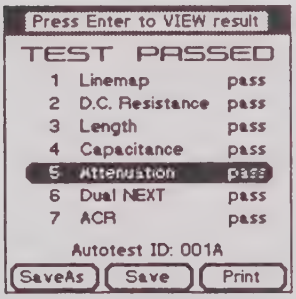
Press **Escape** to return to the Autotest menu.

Attenuation

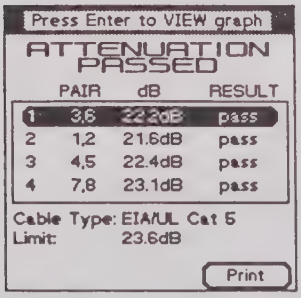
Attenuation measures the overall signal loss in the link and verifies it is within acceptable limits.

The Attenuation is the measured loss of signal strength from one end of a cable to the other. A "Swept Frequency" measurement is taken to insure the cable's integrity. This measurement starts at a low frequency and incrementally steps, making measurements, up to the maximum frequency for the selected cable type. The LANTEK PRO and LANTEK PRO XL perform this sweep on each pair and report the worst case attenuation. The pair will PASS if it does not exceed the limit set for that cable type. Readings are expressed in dB (decibels). All values are negative numbers. By industry convention the negative sign (-) is omitted.

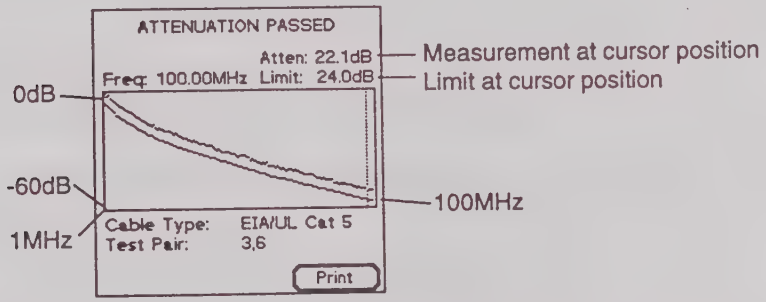
To view attenuation results from the Autotest menu, use the **Number 6** key to select or **Arrow** keys to scroll to "Attenuation."



Press **Enter**.



Attenuation results for each pair are displayed along with the cable type tested.
Since attenuation increases on a linear scale with distance and a logarithmic scale with frequency, a graph is useful for observing the change in measurements. To view attenuation results as a graph, use a **Number** key to select or the **Arrow** keys to scroll to the pair you want to view and press **Enter**.



To view another pair, press **Escape** to return to the pairs menu and select another pair or the **Up/Down Arrow** keys can be used to scroll to other pairs without leaving this screen.

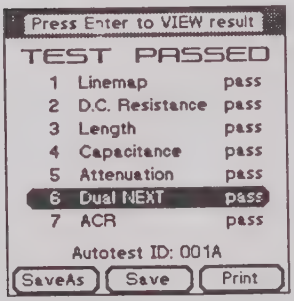
Dual Near End Crosstalk (NEXT)

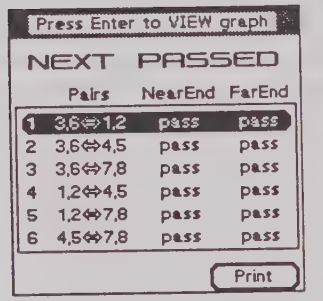
Near end crosstalk is the amount of transmitted signal induced electro-magnetically onto adjacent pairs. High levels can cause excessive retransmissions, data corruption and other problems.

NEXT is a critical test for LAN cable systems, which must support high data transmission rates. Autotest generates swept signals from 1 to 100MHz and measures induced signals on adjacent pairs at precise intervals.

Dual NEXT is Wavetek's trademarked method for measuring NEXT at both the near and far ends of the cable in one Autotest. NEXT is the only measurement which must be performed at both ends of a network's links.

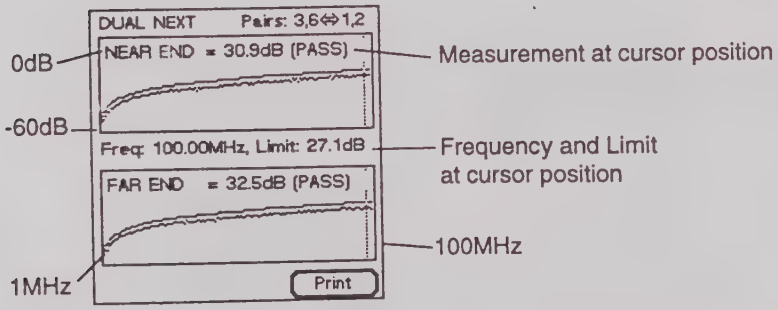
To view crosstalk results from the Autotest menu, use the **Number 5** key to select or **Arrow** keys to scroll to "Dual NEXT," and press **Enter**.





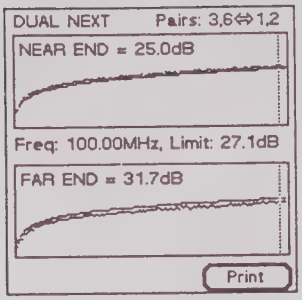
Crosstalk test results for near and far end for all pairs tested are displayed with pass/fail indicated.

Since NEXT increases with frequency, a graph is a useful way to view measurements against recommended limits. To view Autotest NEXT results as a graph, use the **Number** keys to select or **Arrow** keys to scroll to the desired pair and press **Enter**.



Vertical cursors on each graph indicate frequency and crosstalk level in decibels (dB). The measured crosstalk can be clearly seen compared against the acceptable limit line. Points above the limit line indicate failures.

The graph above displays a passing measurement. The limit line is above the measured crosstalk. On the graph below, the measured NEXT for the near end (top graph) is within limits; the NEXT for the far end is outside (above) the set limit so this pair fails NEXT.



To view another pair combination, press **Escape** to return to the pairs menu and select another pair or the **Up/Down Arrow** keys can be used to scroll to other pairs without leaving the screen.

To exit the NEXT graph screens, press **Escape** to return to the pairs menu and again to return to the Autotest results menu.

To troubleshoot a failed NEXT test, use Fault Find as instructed in Chapter 4.

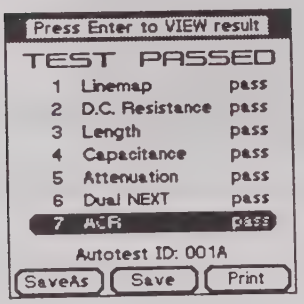
Attenuation-to-Crosstalk Ratio (ACR)

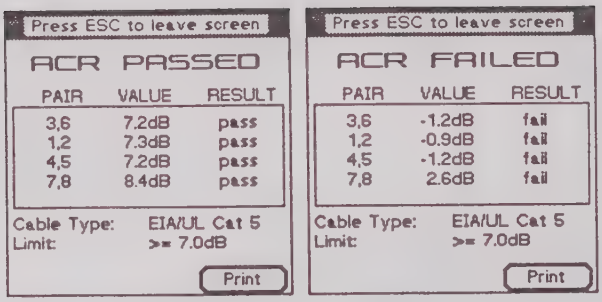
ACR is a comparison of signal strength to noise interference and is an indication of how problem-free the cable line will be.

Attenuation-to-crosstalk ratio (ACR) is not a test, it is a comparison between the results of two previously performed tests: attenuation and NEXT. It compares signal loss (attenuation) to noise interference (NEXT) and gives an indication of how problem-free the cable pair will be for transmissions. A large difference between attenuation and NEXT is desirable, since it indicates a strong signal and little noise interference.

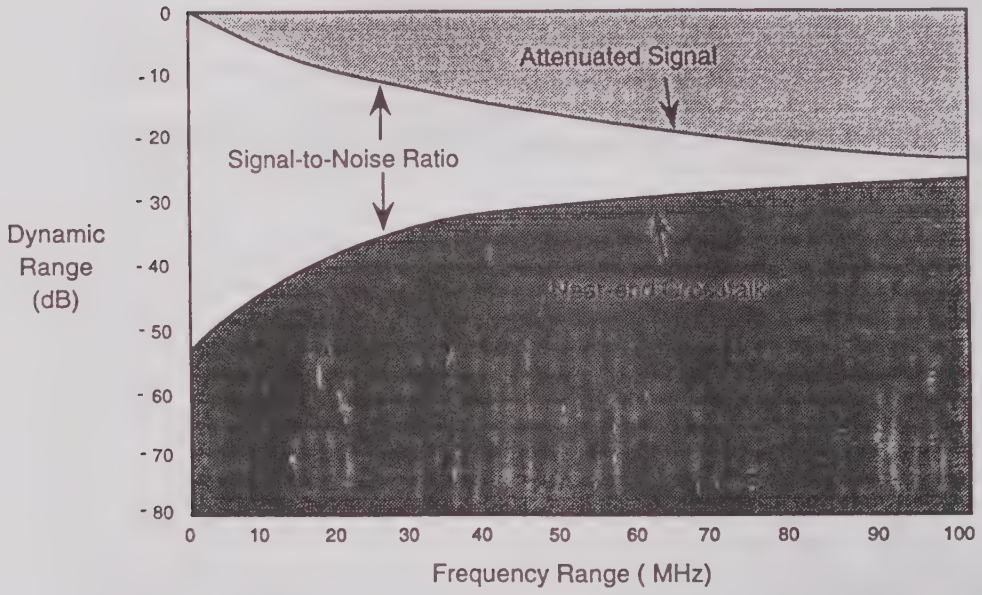
ACR is determined by comparing the largest negative attenuation reading for each pair with the highest negative near and far end NEXT reading for each pair, for all pair combinations. The ACR for each pair is computed mathematically as the difference between these readings for each pair.

To view attenuation-to-crosstalk ratio from the Autotest menu, use the **Number 7** key to select or **Arrow** keys to scroll to "ACR," and press **Enter.**





ACR test results are displayed with pass/fail results and the limit for cable type selected. Since NEXT is measured from both the near and far end, ACR results are displayed for both.

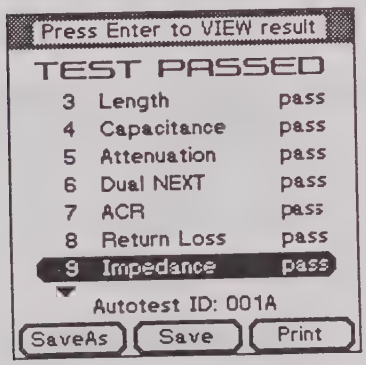


Average Impedance

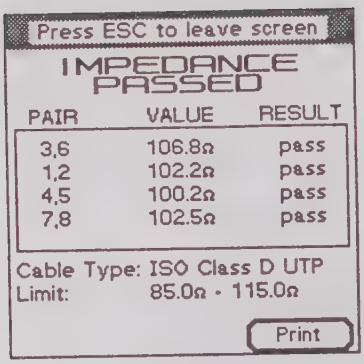
Impedance is a designed-in characteristic of the cabling system components to match the LAN system impedance of 100 Ω, 120 Ω or 150 Ω.

Like ACR, average impedance is not a test, but a value derived from measurements made in other tests. The average characteristic impedance of a cabling run, the ratio of voltage to current at the frequency of LAN applications, has no direct relationship to the DC loop resistance, although both values are given in ohms. Average impedance of each pair should be equal to the LAN system impedance of 100 Ω, 120 Ω or 150 Ω, plus or minus 15 Ω.

To view the average impedance results from the Autotest menu, use the **Number N** key to select or **Arrow** keys to scroll to "Impedance."



Press **Enter**.



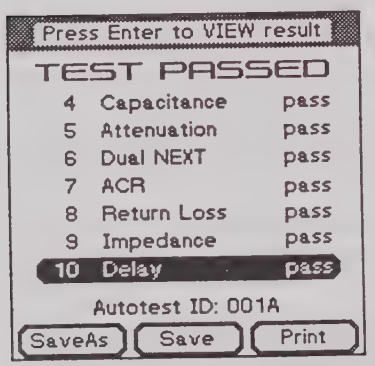
The reasons for average impedance being incorrect are similar to those for a capacitance failure (see the proceeding section under "Capacitance"). To troubleshoot a failed capacitance or average impedance test, use Fault Find, capacitance failure, as instructed in Chapter 4.

Delay

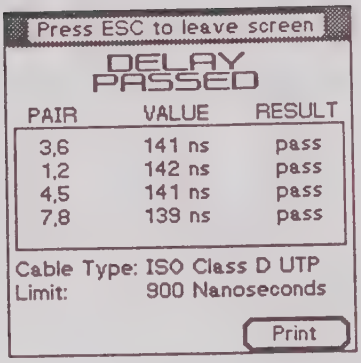
Delay is the period of time for a signal applied to one end of a cable run to reach the other end. Measuring the delay does not require that the nominal velocity of propagation (NVP) of the cable be known.

The delay measurement is made in order to calculate cable length (see the proceeding section under "Length"). Delay is reported for each pair with a value in nanoseconds (1 ns = 10^{-9} seconds). Its value is not affected by length units (feet or meters) or by NVP selection. Many LAN applications are sensitive to delay time, and generally specify less than 1 microsecond (1000 ns) delay. Delay is measured and displayed for each pair with a limit of 900 ns.

To view the delay results from the Autotest menu, use the **Number N** key to select or **Arrow** keys to scroll to "Delay."



Press **Enter**.



Excessive delay is due to excessive length. Delay may also differ slightly between pairs in the same cable. A substantial difference in delay signifies a problem, such as a break or short in the pair. To troubleshoot a failed delay or length test, use Fault Find, length failure, as instructed in Chapter 4.

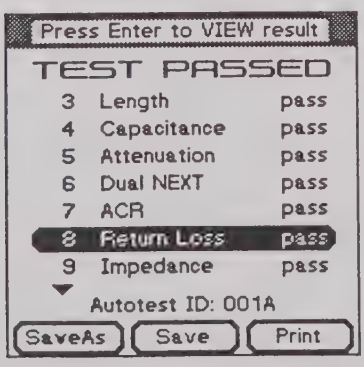
Return Loss

Return loss is a measurement of the ratio between transmitted signal strength and signal reflected back to the transmitting end. Like attenuation, excessive return loss reduces signal strength at the receive end. It also indicates a mismatched impedance at some point along the cable run.

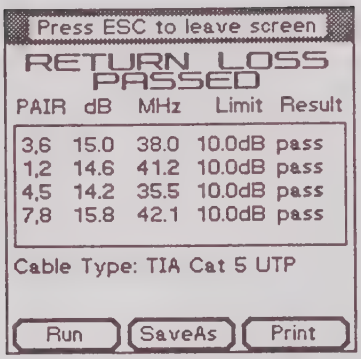
Return loss is given as a value in dB for each pair. As an example, a value of "20 dB" is a 10:1 voltage ratio between the transmitted and reflected signal. This means that 9/10 of the transmitted signal propagates toward the receive end, and 1/10 is reflected back to the transmit end. A value of 20 dB or greater is very good for twisted pair cable, a value of 10 dB or less is very bad (large reflection). A low dB value for return loss indicates an impedance discontinuity, or sudden transition from one impedance value to another, hence the large reflection of signal back to the source.

Return loss measurements are made at the same time that NEXT between pairs is measured by the display handset. While NEXT is measured on adjacent pairs as one pair is performing a 1 MHz to 100 MHz sweep, the return loss is measured at the source pair.

To view the return loss results from the Autotest menu, use the **Number N** key to select or **Arrow** keys to scroll to "Return Loss."



Press Enter.



Troubleshoot excessive return loss by looking at the length results for an opened or shorted pair, or by running the diagnostic TDR test (see Chapter 4, "TDR") for the LANTEK PRO XL only.

4 | Using Fault Find

Running Fault Find

Fault Find runs an Autotest with Cable Expert or continuous mode tests that allow you to monitor the cable during troubleshooting.

Fault Find runs either an Autotest with Cable Expert advice on failures or individual diagnostic tests. The diagnostic tests run in a continuous mode, allowing you to troubleshoot by making adjustments and observing changed test results. For example, a failed capacitance measurement can indicate kinks or stretches in the cable. With Fault Find running, you can walk the cable and check for damage and stretching. Freeing the cable at suspected problem areas should improve the measured reading.

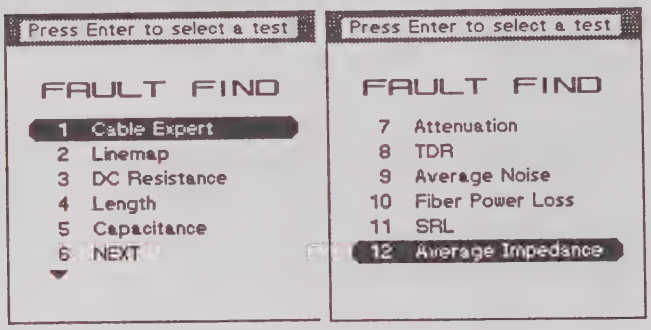
Fault find performs diagnostic testing for the following:

1. Cable Expert
2. Line map
3. DC resistance
4. Capacitance
5. Attenuation
6. NEXT
7. Attenuation
8. TDR graph (PRO XL only)
9. Average noise (PRO XL only)
10. Fiber power loss
11. Return loss
12. Average impedance

Cable Expert is a special program in Fault Find that runs an Autotest to find problem areas and displays troubleshooting advice.

Fault Find results can be printed while viewing each individual test using the **Print (F3)** option key or saved using the **SaveAs (F2)** option key.

To begin Fault Find diagnostic testing, press the **Fault Find** key.



Use the **Number** keys to select or **Arrow** keys to scroll to the desired test. Make sure the tester is connected to the cables as shown in Test Connections, Chapter 1.

Press **Enter** to begin testing.

Running Cable Expert

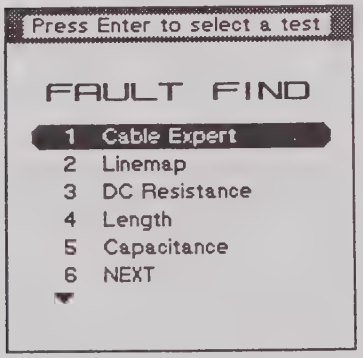
Cable Expert *allows you to quickly find problem areas using an Autotest and troubleshoot using the Advice program.*

Cable Expert runs the Autotest, but automatically diverts to assistance screens with advice to help you troubleshoot the problem found. Cable Expert should be used when the Autotest results indicate a failure:

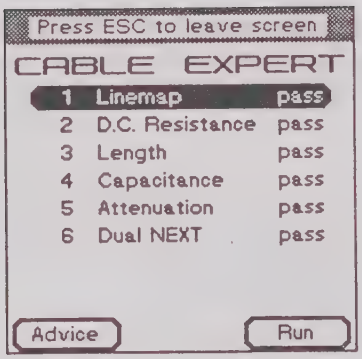
Line Map
DC Resistance
Length
Capacitance
Attenuation
Dual NEXT

To begin Cable Expert testing press the **Fault Find** key.

Select Cable Expert by pressing the **Number 1** key or **Enter**.

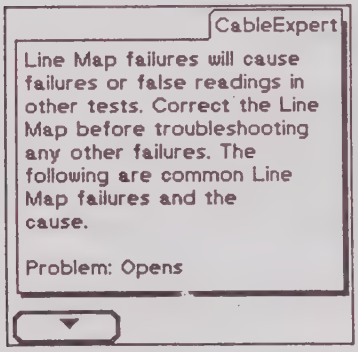


Cable Expert runs a suite of diagnostic tests, displaying a bar graph to indicate progress. When all tests are completed, the display will pause briefly, allowing you to see the test results and then will display troubleshooting advise based on the type of failure.



To troubleshoot, make recommended repairs or replacements and run Cable Expert again by pressing the **Run (F3)** option key.

To view Cable Expert test results, press **Escape**. To return to the Advice screen press the **Advice (F1)** option key.

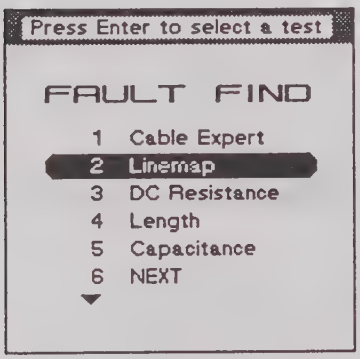

CableExpert
Line Map failures will cause failures or false readings in other tests. Correct the Line Map before troubleshooting any other failures. The following are common Line Map failures and the cause.
Problem: Opens

Press **Escape** to return to the Fault Find menu.

Line Map

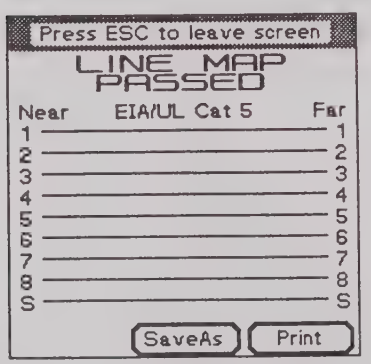
Line map can find shorts, opens and miswires.

Line map in Fault Find can be used to locate shorts, opens and miswires. To perform line map, press **Fault Find** to access the Fault Find test menu.

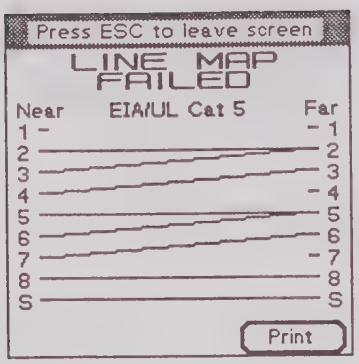


Use the **Number 2** key to select or **Arrow** keys to scroll to "Line Map."

Press **Enter** to begin testing. The unit will display a continuous mode line map diagram.



Shown above are typical line map results for a passed test. Notice the lines indicating the cable run from the near to the far end, with appropriate connections.



Now observe the results from the failed line map test shown above. Improper connections are shown for pins 3, 4, 6, and 7, indicated by the diagonal line between the pins. Check the connections at the punch-down block; pins have probably been miswired or the connectors are defective.

Pin 1 is an open circuit, as indicated by the short dash in place of a line connecting the pins. Check connections on these pins for incomplete wiring and then run TDR or length testing on these pairs to locate the approximate location of the open. The TDR graph will show a sudden upswing at the location of an open. A comparison of pair lengths will show a discrepancy on the damaged pair.

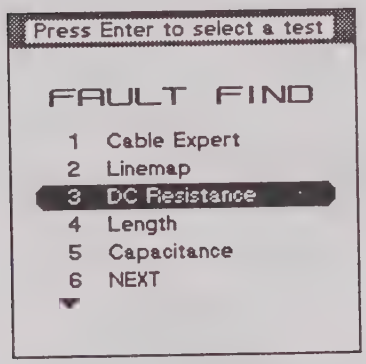
Test results can be printed at any time using the **Print** option key **(F3)** or saved using the **SaveAs** option key **(F2)**.

Press and hold **Escape** to exit line map testing.

DC Resistance

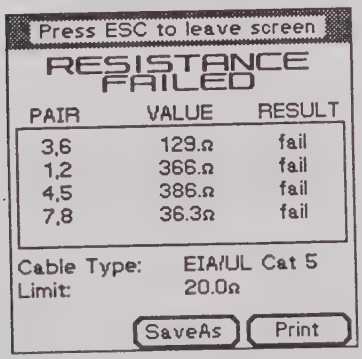
DC loop resistance indicates shorts or opens in the cable or connector problems.

DC resistance in Fault Find can be used to locate conductivity faults in the cable or connectors. To perform DC resistance testing, press **Fault Find** to access the Fault Find test menu.



Use the **Number 3** key to select or **Arrow** keys to scroll to "DC Resistance."

Press **Enter** to begin testing.



DC resistance measurements are displayed for each pair with pass/fail results. The limit and cable type are displayed for comparison. Readings are performed in continuous mode, so results change as the cable or connectors are moved.

Observe the results from the failed resistance test above. Resistance limits are exceeded on all pairs, indicating a probable connector problem or a defective cable that affects all pairs.

Use TDR testing to determine the approximate location of the fault. The TDR graph will show a peak or valley at the location of the fault. After determining the distance, repair or replace as necessary and see if DC resistance results change.

If a cable problem is not apparent from TDR testing, check the connections at the punch-down block closest to the Display Handset.

Test results can be printed at any time using the **Print** option key **(F3)** or saved using the **SaveAs** option key **(F2)**.

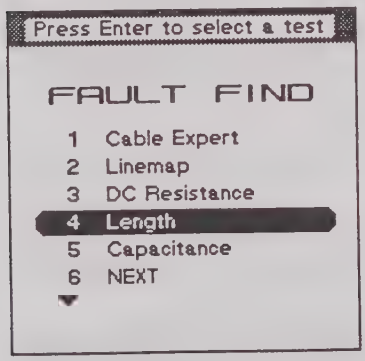
Press **Escape** to exit resistance testing.

Length

Length measurements indicate faults when pair measurements differ by more than 10% from each other.

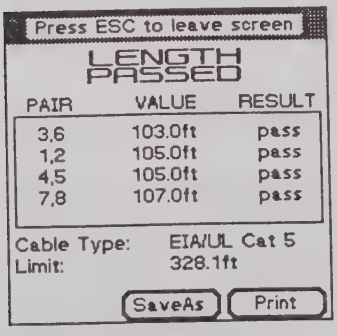
Length in Fault Find can be used to indicate faults when the individual pair length measurements differ from each other significantly (more than 10%). If any pair length measurements exceed the length limits, the cable is too long.

To perform length testing, press **Fault Find** to access the Fault Find test menu.



Use the **Number 4** key to select or **Arrow** keys to scroll to "Length."

Press **Enter** to begin testing.



Length measurements are displayed for each pair with pass/fail results. The limit and cable type are displayed fo comparison.

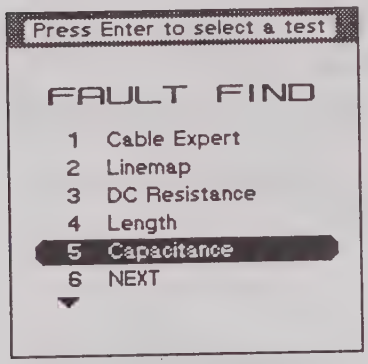
Test results can be printed at any time using the **Print** opti key **(F3)** or saved using the **SaveAs** option key **(F2).**

Press **Escape** to exit length testing.

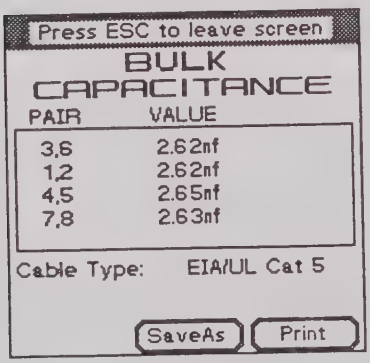
Capacitance

Excessive capacitance can indicate connector or pair insulation defects.

Capacitance in Fault Find can be used to detect damaged cable or connector defects. To perform capacitance testing, press **Fault Find** to access the Fault Find test menu.



Use the **Number 5** key to select or **Arrow** keys to scroll to "Capacitance" and press **Enter** to begin testing.



Capacitance measurements for each pair shows bulk capacitance or the total dielectric constant for the pair as opposed to capacitance/foot (meter). Therefore no limit and no pass/fail indication is provided. Dividing the length into this reading will provide the per foot (meter) capacitance. It is more accurate to divide by the known jacket length of the cable,

since errors in capacitance can affect the NVP and instrument's length measurements. Readings are performed in continuous mode, so results change as the cable or connectors are moved or repaired.

> High capacitance on a pair(s) will also be accompanied by longer length readings for the same pair(s).

Use TDR testing to determine the approximate location of the problem. The TDR graph will show a peak or valley at the location of the kink or other interruption. After determining the location, repair or replace as necessary and see if capacitance results have improved.

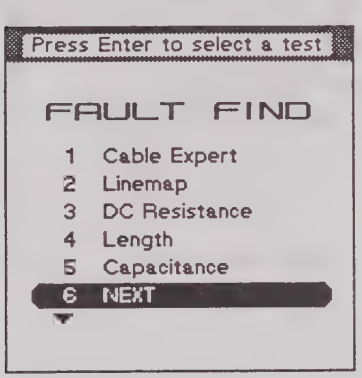
Test results can be printed at any time using the **Print** option key **(F3)** or saved using the **SaveAs** option key **(F2)**.

Press **Escape** to exit testing.

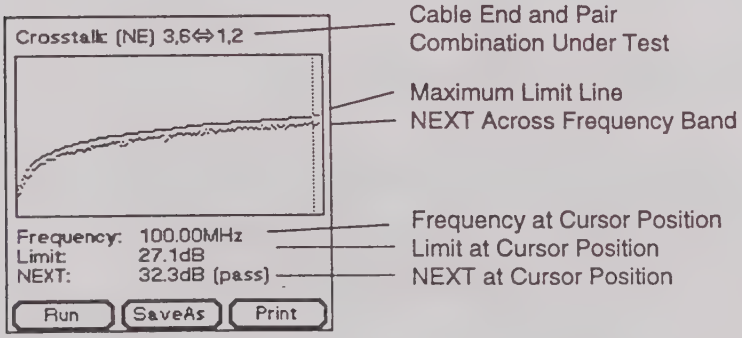
Near End Crosstalk (NEXT)

NEXT (near end crosstalk) testing identifies excessive noise interference between twisted pairs.

NEXT or crosstalk testing in Fault Find can be used to find unacceptable levels of noise interference in twisted pair cable. Crosstalk interferes with network communication, causing errors that can slow down the network. To perform NEXT testing, press **Fault Find** to access the Fault Find test menu.



Use the **Number 6** key to select or **Arrow** keys to scroll to "NEXT." Press **Enter** to begin testing.



Results for the cable end and pair combination are displayed in graph form with a moving vertical cursor bar. Crosstalk, frequency and limit are displayed for each point on the graph line when selected by the cursor bar. Use the **Left/Right Arrow** keys to move the cursor bar.

NEXT changes in both frequency and amplitude from each end. Recommended limits are displayed graphically with measured results.

NEXT testing is performed once, and then paused to allow you to select another pair or continue testing. To resume testing, press the **Run** option key **(F1)**.

To view results for a different pair, use the **Up/Down Arrow** keys to scroll to a new pair. Press the **Run** option key **(F1)** to re-test the new pair.

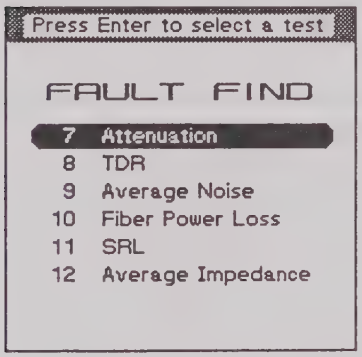
Test results can be printed at any time using the **Print** option key **(F3)** or saved using the **SaveAs** option key **(F2)**.

Press **Escape** to exit testing.

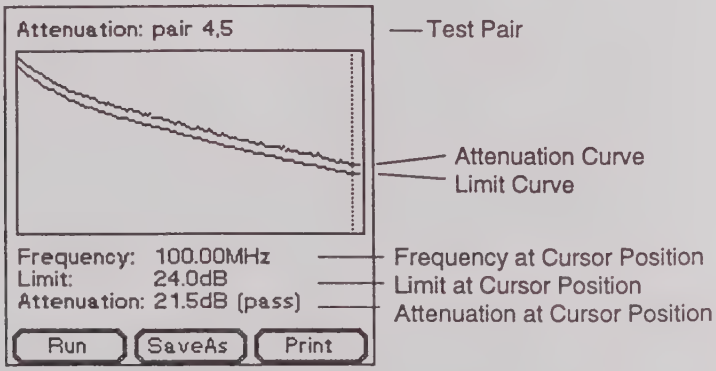
Attenuation

Attenuation testing can detect excessive signal loss in a cabling link.

Attenuation testing in Fault Find can be used to find problems in the cable, connectors or connecting hardware. To perform attenuation testing, press **Fault Find** to access the Fault Find test menu.



Use the **Number 7** key to select or **Arrow** keys to scroll to "Attenuation." Press **Enter**.



Results are displayed in graph form with a moving vertical cursor bar. Frequency, attenuation and limit are displayed for each point on the graph line when selected by the cursor bar. Use the **Left/Right Arrow** keys to move the cursor bar.

To view results for a different pair, press the **Up/Down Arrow** keys to change. The test runs one time and displays the results. Press the **Run** option key **(F1)** to re-test the new pair.

Test results can be printed at any time using the **Print** option key **(F3)** or saved using the **Saveas** option key **(F2)**.

Press and hold down **Escape** to exit testing.

Using the TDR (downline impedance graph)

One of the most powerful diagnostic tools available for metallic cable troubleshooting is a TDR with downline impedance measurement capabilities such as the LANTEK PRO XL. In many cases, this tool provides more useful information about a cable's electrical characteristics than any other type of portable test equipment.

Impedance is defined as the dynamic opposition to signal flow in a transmission medium. It is comprised of values of resistance, capacitance, and inductance. These three characteristics are not consistent along a cable's length due to small structural variations that occur during the manufacturing process. There are two types of impedance measurements which are currently performed, characteristic impedance and relative or TDR impedance.

Characteristic impedance is usually measured in a laboratory with complex test equipment such as a network analyzer and an S-parameter (Scatter parameter) test set. It is performed at various test frequencies and is an average value for a particular length of cable (usually 1000'). This characteristic impedance value will be one number that may vary only with the frequency of the test signal. In a cable catalog, it is this type of impedance that is listed as a specification for a particular cable type. Some familiar characteristic impedance values are:

- 100 Ω Unshielded Twisted Pair
- 50 Ω RG-58 Coaxial
- 150 Ω IBM Type 1 Shielded Twisted Pair
- 93 Ω RG-62 Coaxial

From a troubleshooting standpoint, characteristic impedance has little or no value. Part of the cable certification process for the EIA/TIA cable standards require specific impedance characteristics. If the UTP cable is stamped with

a "UL Level 5" designation, its characteristic impedance has already been verified through 100MHz.

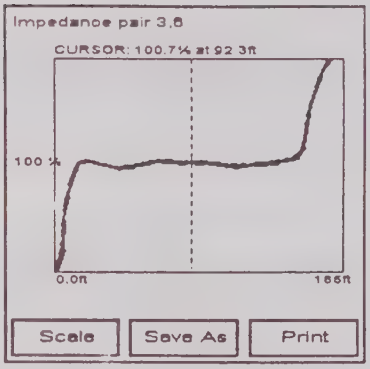


Figure 1. Good Downline Impedance

TDR impedance is measured as a function of length. It is performed by sampling and analyzing the quality of reflections from a test pulse sent from the LANTEK down the cable under test. Information from this analysis is a graphic picture of the cable's structure along its length. This is invaluable for evaluating an installed cable's performance because any changes in the cable (crimps, kinks, stretches, etc.) are displayed as features (blips, peaks, or valleys) in an otherwise flat line.

Testing for near-end crosstalk, attenuation, and mutual capacitance is critical to insure a proper installation, but may not reveal much more than whether an entire link is good or bad. By measuring a link's downline impedance, a network service provider can quickly determine if the cabling is a problem and where that problem is. Figure 2 shows an example of a resulting graph when faulty cable is tested.

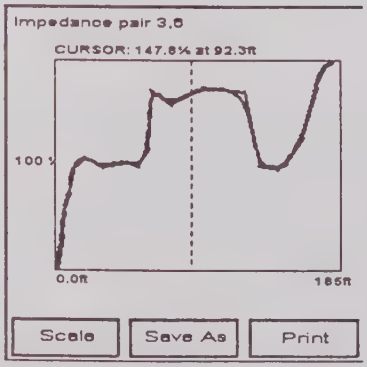


Figure 2. Impedance mismatch caused by a split pair.

Unlike traditional TDR's, the LANTEK PRO XL requires no operator adjustments and very little interpretation. Graphic plots are provided complete with references for impedance values in ohms and length in feet or meters. The LANTEK is the only full function TDR

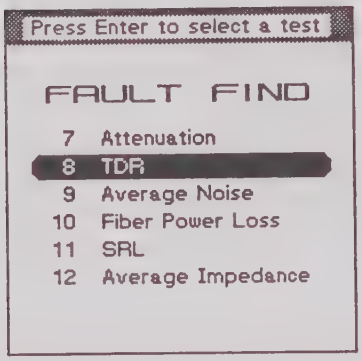
with a built-in interface for testing twisted-pair wiring systems.
As a tool for coaxial and twinaxial networks, the LANTEK PRO XL is ideal. The key measurements for these systems are maximum length and downline impedance. Defects such as faulty "tee" connectors, bad vampire taps, captured water, and other structural problems can be found easily and quickly as features on the impedance graph.

The TDR impedance measurement on the PRO XL combines individual resistance (connectors and terminations), inductance (NEXT and pair splits), and capacitance (damage and stretching) measurements. The result is a graphic display of all the important electrical characteristics in one easy to read picture.The LANTEK PRO XL is the ultimate cable diagnostic tool.

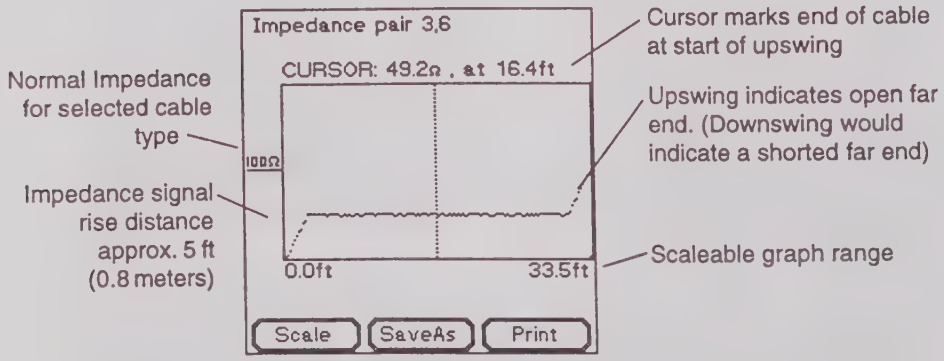
TDR (LANTEK PRO XL only)

TDR testing can locate a physical problem with the cabling system and the distance to it.

To perform TDR testing, press **Fault Find** to access the Fault Find test menu.



Use the **Number 8** key to select or **Arrow** keys to scroll to "Impedance." Press **Enter**.


Impedance pair 3,6
CURSOR: 49.2Ω , at 16.4ft
100Ω
0.0ft
33.5ft
Scale
SaveAs
Print
Normal Impedance for selected cable type
Impedance signal rise distance approx. 5 ft (0.8 meters)
Cursor marks end of cable at start of upswing
Upswing indicates open far end. (Downswing would indicate a shorted far end)
Scaleable graph range

Results are displayed in graph form with a moving vertical cursor bar. Distance from the near end, TDR along the length, and far end are displayed for the selected pair.

How to use the Impedance Graph

Once the graph is on screen, note the pair being displayed. Use the **Up/Down Arrow** keys to change pairs as desired.

Press the **Scale** key (**F1**) to change the graph's range. The graph's range is shown at the lower right corner of the graph and will jump down in range with each press of the **Scale** key. Adjusting the scale will bring the impedance plot of the cable into better view for the length of the cable. Stop pressing the Scale key when the plot appears as shown in the preceding screen view. If the scale becomes too short to display the entire plot, continue to press the **Scale** key will toggle it to the long scale (4000+ feet or 1200+ meters) and start the zoom again.

Use the **Left/Right Arrow** keys to move the cursor. To find the end of the cable move the cursor to intersection of the level plot and the upswing or downswing on the right side of the plot. The plot will swing up when the end of the cable pair is open and down when the end of the cable pair is shorted.

If the trace is relatively flat from the upswing point at the near end (left side) along the select cable's indicated impedance line (e.g., 100Ω, 50Ω, etc.) until the upswing (downswing) point at the far end of the cable, then the impedance is nominally correct along the entire length of the pair. If large peaks or dips appear in the plot, move the cursor to the left-most point of the discontinuity. The cursor position readout indicates the distance to the cable or connection point fault.

The following are impedance troubleshooting tips to help you rapidly locate faults.

(1) If one pair is shorted or open, use the cursor to mark the distance on a good pair first. Then shift to the bad pair using the up/down arrow keys. Now move the cursor to the leading edge of the short (downswing) or open (upswing) and note the difference in distance. Take six feet (two meters) off this difference to find the distance to the problem from the far end of the cable. See math example below:

	feet	meters
Electrical length of good pair	155	47.3
Less length to bad pair's indicated end	139	42.4
	= 16	= 4.9
Less Remote Handset's test lead	6	2.0
Distance to fault from far end connector	= 10	= 2.9

The short or open is about 10 feet (2.9 meters) in from the far end connector

(2) The upswing portion of the trace is the distance required to fully develop the test signal's wave length and receive a readable reflection. If the cable is open or shorted at or near the near end of the cable, this upswing will not be fully developed.

(3) If the plot contains a high or low discontinuity outside the +10% limit, move the cursor to the left edge of this excursion. Position the cursor at the intersection of the level plot area and the upswing or downswing to obtain the distance from the Display Handset to the start of the problem area.

(4) If the plot is level, but much higher or lower than the selected cable's impedance marker, either the wrong cable type has been selected or the cable is of higher or lower impedance than the type selected. Check both the cable type selected and cable for correct impedance. Some examples are listed below:

TIA Cat 3, 4 or 5 twisted pair	= 100 ohm
Token Ring Types	= 150 ohm
10BASE-2 (RG-58 coax)	= 50 ohm
10BASE-5 (Thicknet coax)	= 50 ohm
ARCNET (RG-62)	= 93 ohm

(5) If the plot never shows an upswing in the first 10 feet (2.8 meters), the pair is most likely shorted at the connection closest to the Display Handset.

(6) If the plot is much longer than the cable's reasonable length and has no distinct upswing or downswing on the far end, there is a matched terminator attached to the far end. The sharp upswing or downswing of the impedance plot marks the "end-of-cable reflection." If a matched terminator is attached there will be no upswing or downswing establishing this mark.

Test results can be printed at any time using the **Print** option key **(F3)** or saved using the **SaveAs** option key **(F2)**.

Press and hold **Escape** to exit testing.

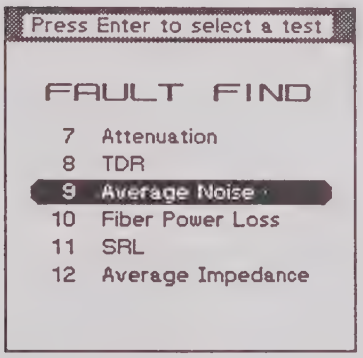
TDR testing is performed by the LANTEK PRO XL model only.

Average Noise (LANTEK PRO XL only)

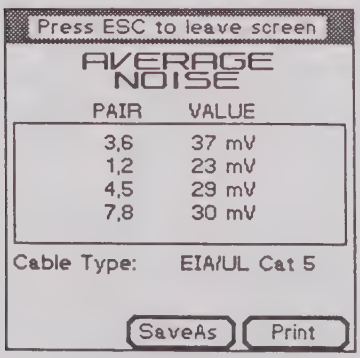
Average noise is a diagnostic test to measure noise wideband interference on the cable line.

Average noise measures rms voltage on each pair of wires using a broadband detector. This is strictly a diagnostic test so pass/fail limits are not applied. Average noise measures the signal picked up by the cable from external radiating sources, such as AC power lines, motors or other electrical equipment. A high reading may indicate the cable is too close to electrical interference sources.

To perform average noise testing, press **Fault Find** to access the Fault Find test menu.



Use the **Number 9** key to select or **Arrow** keys to scroll to "Average Noise." Press **Enter**.



Average noise measurements are displayed for each pair with measured rms voltage values. Readings are performed in continuous mode, so results change as the cable or noise source are moved. Readings below 100mV are generally acceptable. Readings above this level require corrective action.

Test results can be printed at any time using the **Print** option key **(F3)** or saved using the **SaveAs** option key **(F2)**.

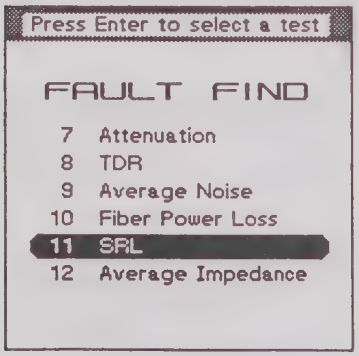
Press **Escape** to exit testing.

Average noise testing is performed by the LANTEK PRO XL model only.

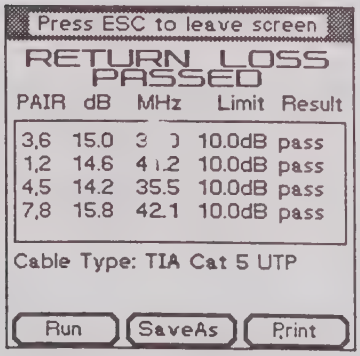
Return Loss

Excessive return loss can indicate defective terminations, incorrectly chosen patch cables or cross-connects, and physical problems with the cable run.

Return loss testing in Fault Find can be used to identify physical problems with the cable which result in non-uniform impedance, such as poor connector terminations or cable segments with incorrect characteristic impedance. To perform the return loss test, press **fault Find** to access the Fault Find test menu.



Use the **Number 12** key to select or **Arrow** keys to scroll to "Return Loss." Press **Enter**.



Press **Escape** to exit return loss testing.

Return loss measurements are displayed for each pair with the frequency of worst-case return loss and pass/fail results. The limit and cable type are displayed for comparison. Readings are displayed in continuous mode, so results change as the cable or connectors are moved.

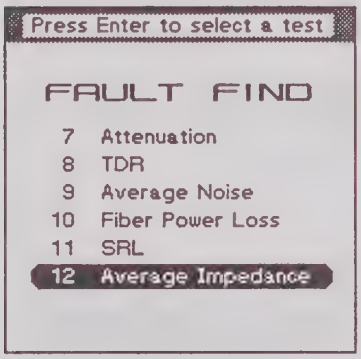
Generally, the TDR test would be used to further isolate the distance to the fault. The TDR plot would show a dip or jump in impedance value at the distance to the fault from the display handset. After determining the distance, repair or replace terminations or cable as necessary and see if the return loss results improve.

Test results can be printed at any time using the **Print** option.

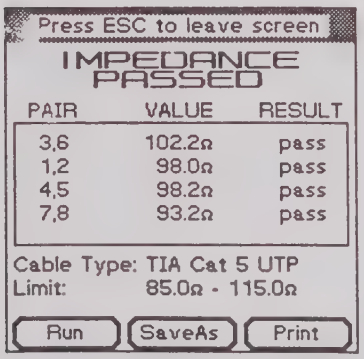
Average Impedance

Impedance can indicate incorrectly chosen patch cables or cross-connects and physical damage.

Average impedance testing in Fault Find can be used to identify physical damage to the cable (much like the capacitance test), connector defects, or cable segments with incorrect characteristic impedance. To perform the average impedance test, press **fault Find** to access the Fault Find test menu.



Use the **Number 13** key to select or **Arrow** keys to scroll to "Avg. Impedance." Press **Enter**.



Impedance measurements are displayed for each pair with pass/fail results. The limit and cable type are displayed for comparison. Readings are displayed one pair at a time, then paused to allow you to select another pair (up/down cursor) or retest current pair **(Run)**.

Generally, the impedance test would be used to further isolate the distance to the fault. The impedance plot would show a dip or jump in impedance value at the distance to the fault from the display handset. After determining the distance, repair or replace patch cables or cross-connects as necessary and see if the impedance results improve.

Test results can be printed at any time using the **Print** option key **(F3)** or saved using the **Save As** option key **(F2)**.

Press **Escape** to exit impedance testing.

5 Managing Test Results

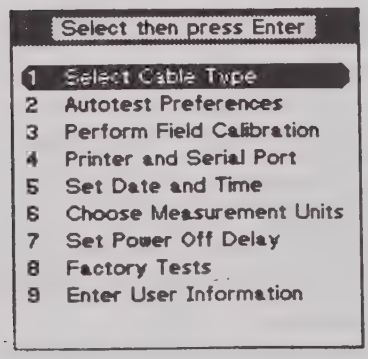
Saving Test Results

LANTEK PRO allows you to store up to 500 Autotest results and view, print, download or rename later.

Test results from both Autotest and Fault Find can be saved and viewed, printed, downloaded, renamed, or deleted at a later time. Up to 500 Autotest results can be stored. Graphical results cannot be saved but can be printed using the **Print** (F3) option key in Autotest or Fault Find.

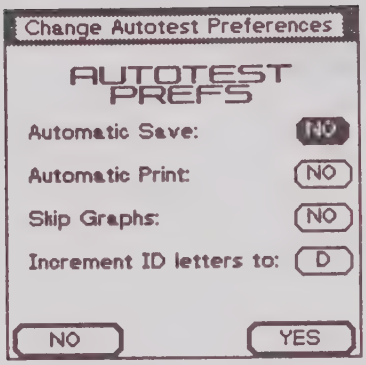
Autotest results can be saved automatically using the autosave option available in the Setup menu or manually following completion of the suite of tests.

Saving Autotest Results
To use the autosave feature press the **Setup** key to display the Setup menu.


Select then press Enter
1 Select Cable Type
2 Autotest Preferences
3 Perform Field Calibration
4 Printer and Serial Port
5 Set Date and Time
6 Choose Measurement Units
7 Set Power Off Delay
8 Factory Tests
9 Enter User Information

Use the **Number 2** key to select or **Arrow** keys to scroll to "Autotest Preferences."

Press **Enter**.



Press **Yes (F3)** to activate the automatic save function for Autotest. If you want to automatically print results as well, use the **Arrow** keys to scroll down to "Automatic Print" and press **Yes (F3)** to activate.

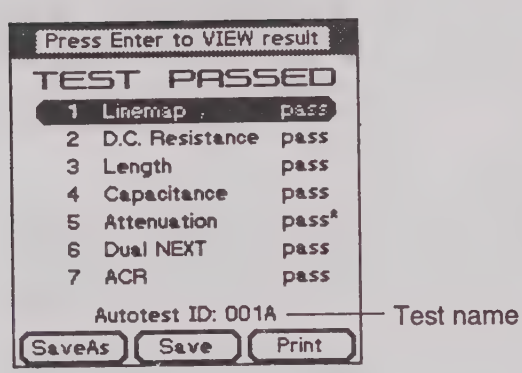
To set the automatic sequencing for test ID, use the **Arrow** keys to scroll down to "Increment ID letters to." Use the **Alphanumeric** keys to enter the letter that represents, for example, the number of jacks per office outlet being tested.

☛ The LANTEK PRO automatically names each test in sequence based on the increments selected in the Autotest setup menu. The default increment is "D" or four tests per sequence. Using the default, the tests will be labeled as 001A, 001B, 001C, 001D, 002A, 002B, 002C, 002D, etc.

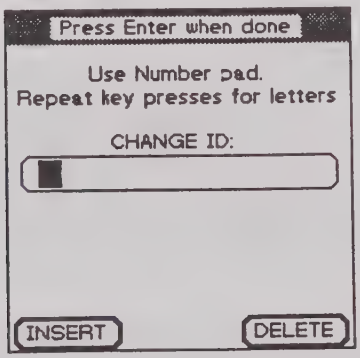
Press **Escape** to exit the Autotest Setup menu.

If you have not set up the Autotest automatic save feature, you can save results manually at the completion of each suite of tests. Press the **Save** option key **(F2)** while in the Autotest pass/fail menu.

☛ In Autotest, results for the entire suite of tests are saved as one file.



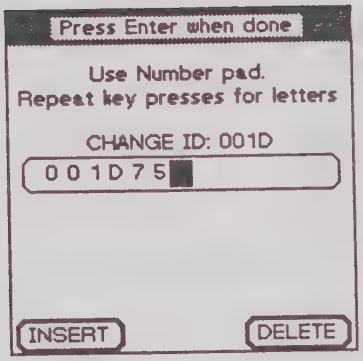
Both the **Save** key and automatic save option store the test results with the test name indicated at the bottom of the screen. To save the test results using a different ID name, press the **SaveAs (F1)** option key.



A name box will be displayed. Use the **Alphanumeric** keys to enter your selection for number and letter changes. Any combination of up to thirteen letters and numbers may be chosen.

The **Insert (F1)** and **Delete (F3)** keys may be used to add spaces or shorten the test ID.

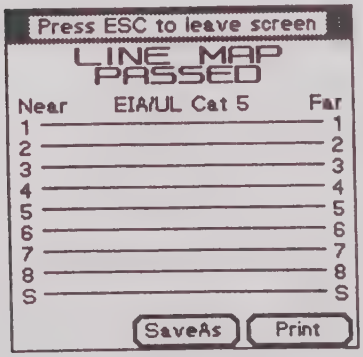
The **Arrow** keys can be used to move to the next entry or after three seconds, the cursor will move automatically one position to the right and wait for the next letter or number input.



After the name has been created, press **Enter** to return to the Autotest pass/fail results menu. The test results will be saved under the name entered.

Saving Fault Find Results

Fault Find test results can also saved and viewed, printed, or downloaded later. To save results while working in Fault Find, press the **SaveAs** option key **(F2)**.

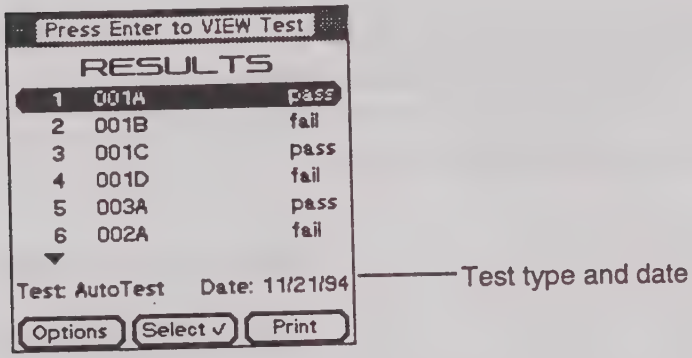


A name box will be displayed. Use the instructions on page 5-3 to enter a test ID name.

Viewing Test Results

Test results can be viewed while in Autotest and Fault Find or saved and viewed later using Test Results.

Test results can be viewed while in Autotest and Fault Find or saved and viewed later using Test Results. To view stored test results, press the **Test Results** key.

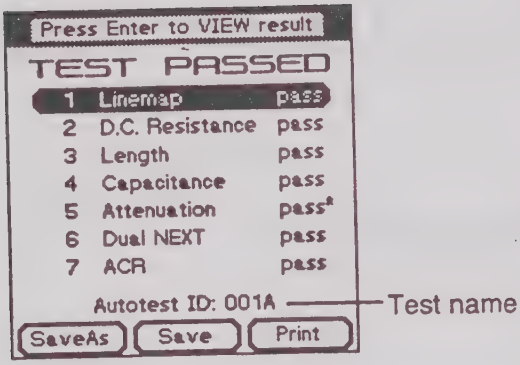


Tests are listed in the order they are saved. The test type and date for the highlighted test are displayed at the bottom of the screen.

To view results, use the **Number** keys to select or **Arrow** keys to scroll to the results desired.

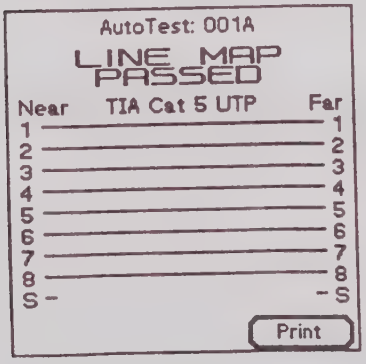
> To scroll faster through a large list of results, hold the Arrow key down for longer than 2 seconds. The scroll rate will accelerate.

Press **Enter** to view results.



Autotest results are displayed with the individual tests and results listed. The test name is displayed at the bottom of the screen. To view individual test results, use the **Number** keys to select or the **Arrow** keys to scroll to the desired test.

Press **Enter** to view.



While viewing, tests can be printed using the **Print** option key (F3).

Press **Escape** to return to the Test Results menu.

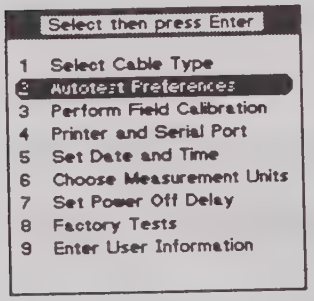
Printing Test Results

Test results can be printed automatically in Autotest or manually in Autotest or Fault Find. Saved tests can also be printed later from the Test Results menu.

Autotest results can be printed automatically using the automatic print feature available in the Setup menu manually following each suite of tests using the **Print** option key, or later from stored test results using the Test Results menu.

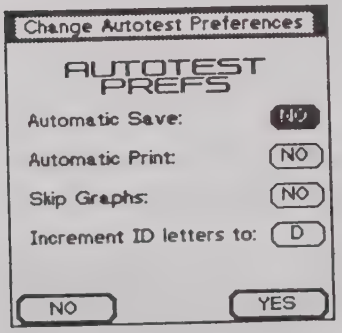
Fault Find results can be printed immediately following the tests using the **Print** option key or printed later from the stored test results menu if the test has been saved.

Printing Autotest Results
To use the autoprint feature, press the **Setup** key to display the Setup menu.


Select then press Enter
1 Select Cable Type
2 Autotest Preferences
3 Perform Field Calibration
4 Printer and Serial Port
5 Set Date and Time
6 Choose Measurement Units
7 Set Power Off Delay
8 Factory Tests
9 Enter User Information

Use the **Number 2** key to select or **Arrow** keys to scroll to "Autotest Preferences."

Press **Enter.**

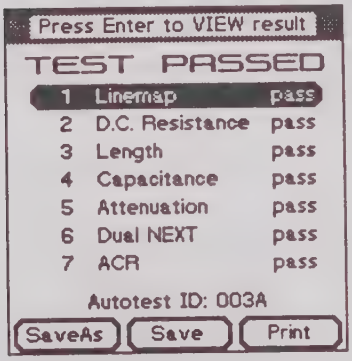


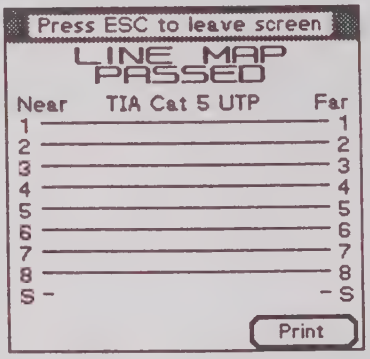
Use the **Arrow** keys to scroll down to "Automatic Print" and press **Yes (F3)** to activate.

For Automatic Save and Increment ID instructions, refer to page 5.2.

Press **Escape** to exit the Autotest Setup menu.

If you have not set up the Autotest automatic print feature, you can print results manually at the completion of each suite of tests. Press the **Print** option key **(F3)** while in the Autotest pass/fail menu or while viewing individual tests as shown in the following screens.



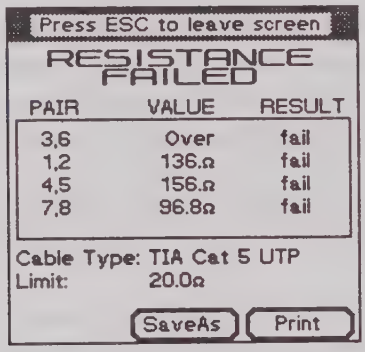


When in the auto-print mode or when the **Print** key **(F3)** is pressed in the Autotest results screen, the entire Autotest results prints as one file.

The **Print** key **(F3)** also appears with each of Autotest's subtest screens. Pressing the **Print** key **(F3)** while in a subtest of Autotest prints only the results for that specific subtest. This feature can be used to print the Line Map only, or specific Attenuation or NEXT graphs available from the Autotest.

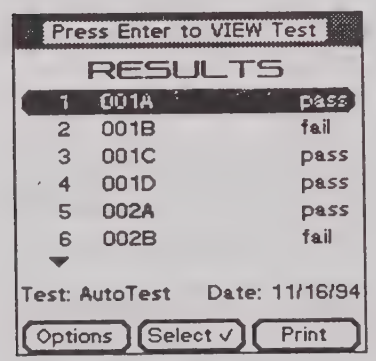
Printing Fault Find Results

*To print individual test results while in Fault Find, press the **Print** option key (F3).*



Printing from the Test Results Menu

To print stored test results for either Autotest or Fault Find, press the **Test Results** key to display the test results menu.



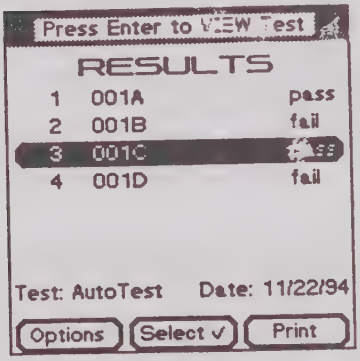
Use the **Number** keys to select or **Arrow** keys to scroll to the test(s) you need to print.

If only one test will be printed, press the **Print** key **(F3)** after you have highlighted the test with the cursor bar.

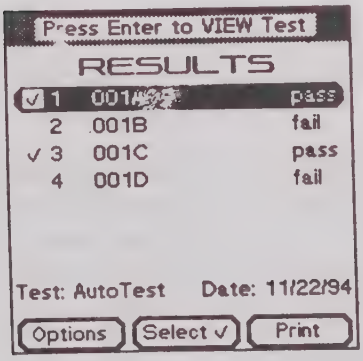
If more than one test will be printed, use the **Arrow** keys to scroll and the **Select** option key **(F2)** to mark all tests desired, then press **Print (F3)**.

Group Test Selection

The Test Results menu allows you to specify and select groups of tests to print or delete. To use the multiple test option feature, press the **Options** key **(F1)**.



Use the **Number** keys to select or **Arrow** keys to scroll to the desired category. The Options menu allows you to select all tests, select all passed tests, select all failed tests, unselect tests, delete selected tests or all tests. After making your selection, press **Enter** to return to the Results menu.



The selected group of tests can now be printed using the **Print** option key **(F3)**.

While in the Options menu you can delete tests already selected under the Results menu, using the **Number 5** key. To delete all tests in memory, use the **Number 6** key.

Press **Enter** to initiate action.

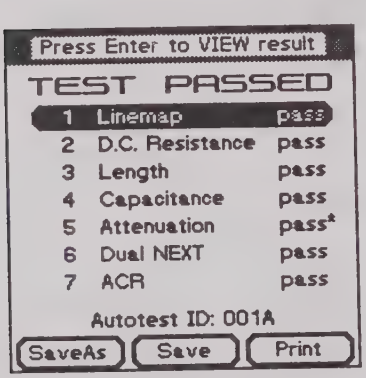
Renaming Test Results

Tests can be renamed immediately after testing or in the Test Results menu.

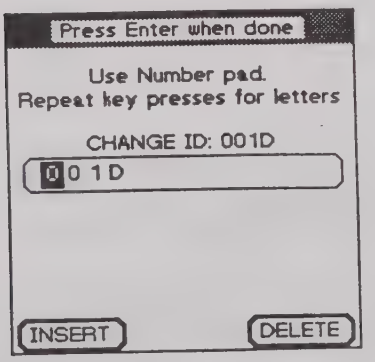
Autotest results are automatically named in sequence if the **Save** option key **(F2)** is used to save test results. Test results can be given a different name by using the **SaveAs** option key **(F3)** or can be renamed in the Test Results menu.

Fault Find test results are given names manually when saved and can be renamed using the Test Results menu.

Renaming Autotest Results
To change the test name assigned automatically in Autotest, use the **SaveAs** option key.

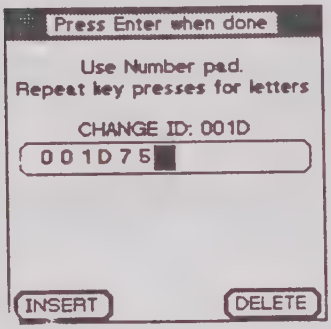


The unit will display the current test name.



Use the **Alphanumeric** keys to enter your selection for number and letter changes. Any combination of thirteen

letters and numbers may be chosen. The **Insert (F1)** and **Delete (F3)** keys may be used to add spaces or shorten the file name.

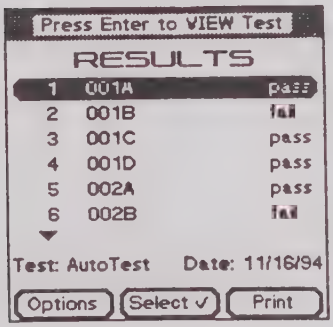


The **Arrow** keys can be used to move to the next entry or after three seconds, the cursor will move automatically one position to the right and wait for the letter or number input.

After the name has been created, press **Escape** to return to the Autotest pass/fail results menu.

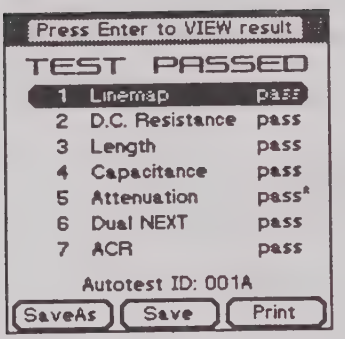
Renaming Fault Find Results

To rename a stored test result, press the **Test Results** key.

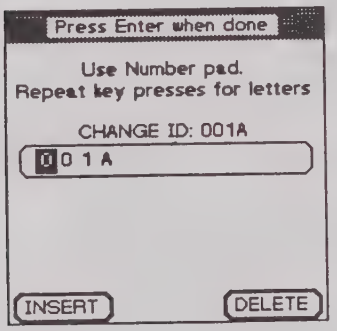


Use the **Number** key to select or the **Arrow** keys to scroll to the test you want to rename.

Press Enter to select.



The test results will be displayed. Press the **Rename** option key **(F2)**.



Use the **Alphanumeric** keys to enter your selection for number and letter changes. Any combination of up to thirteen letters and numbers may be chosen. The **Insert (F1)** and **Delete (F3)** keys may be used to add spaces or shorten the file name.

The **Arrow** keys can be used to move to the next entry or after three seconds, the cursor will move automatically one position to the right and wait for the letter or number input.

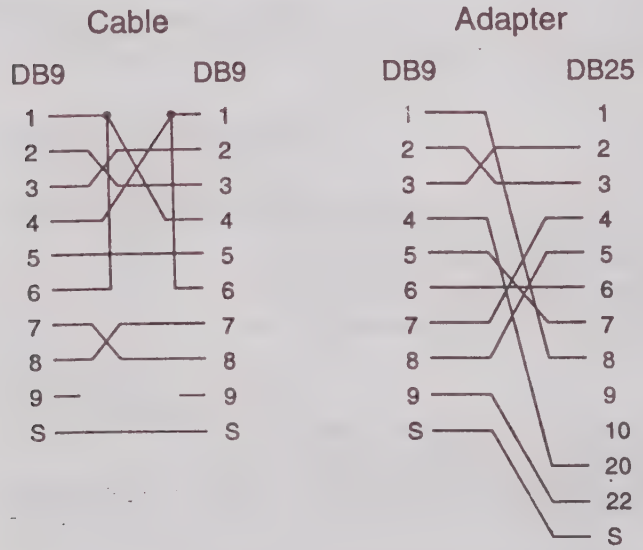
Press **Enter** when the name change is completed. A prompt will ask for confirmation of the name change.

Uploading Test Results to a Computer

Test results can be uploaded to a computer using the LANTEK PRO Utility Disk, allowing data manipulation or additional memory storage.

Autotest test results can be uploaded to a computer with Windows for data manipulation or to provide additional memory storage. The LANTEK PRO Utility Disk provides a simple database structure called a "job file" to organize autotest results and upload them. Once tests are uploaded to the job file, a window called the Test Navigator provides easy viewing, selection, and printing of one or multiple autotests.

To upload, connect the LANTEK PRO Display Handset to an available serial port of your IBM compatible computer, using a DB25 (IBM type PC) or DB9 (IBM type AT) connector. The serial cable and adapter (PRO-SERIAL-KIT) supplied with your instrument will support either IBM-PC or AT connections.



Insert the LANTEK PRO Utility Disk into the computer. Follow the instructions on the Utility Disk to install.

Utility Software

Easy to use program for uploading test results to a PC, storing or copying, tests by jobs, printing test results and upgrading software in the LANTEK PRO / LANTEK PRO XL.

The utility software supplied with your LANTEK PRO / LANTEK PRO XL is designed to enhance your ability to manage test results and keep your instrument current with the latest testing improvements developed by Wavetek.

Windows Utility Features

The Windows utility application loads into any Windows version 3.0 through 3.1. It provides an on screen icon for opening the application window and icon tool bar for quick access to commands. This utility application was specifically designed for ease of use by cable testing technicians to download, store in a database format and print Autotest results. It includes all of the following features:

- Preformatted jobs screen permits easy creation of job records for filing both the job and Autotest results in a data base.
- PC keyboard remote control for uploading from 1 to 500 Autotests stored in the LANTEK PRO / LANTEK PRO XL's memory.
- On screen display of Autotest results, cable types and testing parameters for individual tests.
- Printing of test results to printers under direct PC control or to network printers.
- Copying test results to floppy disks or network storage to maintain customer and job history, detail invoicing information, company records, and backup.
- Customizing job records with individual customer information and your own company's name, address, technicians and other important notes.

- Easy records recall by job, cable drop, test results, date/ time and cable types used.

- On-line help to assist with any and all operations.

Windows Utility Loading and Setup Instructions

1. Make a backup copy of both Utiltiy Disk 1 and 2 using either the DOS or Windows Diskcopy commands.

2. Label the backup copies as Wavetek LANTEK PRO Utilities Disk 1 and Wavetek LANTEK PRO Utility Disk 2 respectively.

3. Store the original disks in a safe location and use the backup copy as a working master for loading the utilities applications.

4. Insert Utility Disk 1 in drive A or B.

5. From Window's Program Manager, use the mouse or **Alt+F** to select **File**, then select **Run**.

6. When the Run window opens, change the Command Line: to A:\INSTALL (or B:\INSTALL if Disk 1 is in the B drive) and press **ENTER** or click on OK to start the installation.

The utilities installation will begin and run automatically. There are programmed stop points at which time you will be prompted via a window for directions to customize the installation with the preferences desired for your PC. If an installation error occurs, you will also be prompted, advised of the error, and given the choice to correct and continue or abort the installation.

Prompts

- The installation program's default destination and directory name will be displayed as C:\Wavetek. If this drive and directory name are acceptable, press **ENTER** or click on OK. If you wish to install the utilities on a different drive or under a different directory name, make the appropriate change now, then press **ENTER** or click on OK and the installation will continue.

- When Disk 1 has completed loading, a prompt will request you insert Disk 2 in drive A (B). Use the same drive as Disk 1 was loaded.
- At the completion of the installation a prompt will query you for icon placement. Accepting the default placement in Program Manager creates a group called "Wavetek." Or you may designate another Window's group to place the LANTEK PRO Utilities icon. In either case, press ENTER or click on OK to finish the installation and exit to Program Manager.

7. To open the LANTEK PRO Utilities application, double-click the mouse on the Wavetek group and double-click again on the LANTEK PRO Utilities icon.

Refer to Operating LANTEK PRO Utilities on the following pages for help with getting started and using this application or use the on-screen help as needed.

DOS Utility Loading and Setup Instructions

1. Make a backup copy of both Utiltiy Disk 1 and 2 using either the DOS or Windows Diskcopy commands.

2. Label the backup copies as *Wavetek LANTEK PRO Utilities Disk 1* and *Wavetek LANTEK PRO Utility Disk 2* respectively.

3. Store the original disks in a safe location and use the backup copy as a working master for loading the utilities programs.

4. Insert Utility Disk 1 in drive A or B.

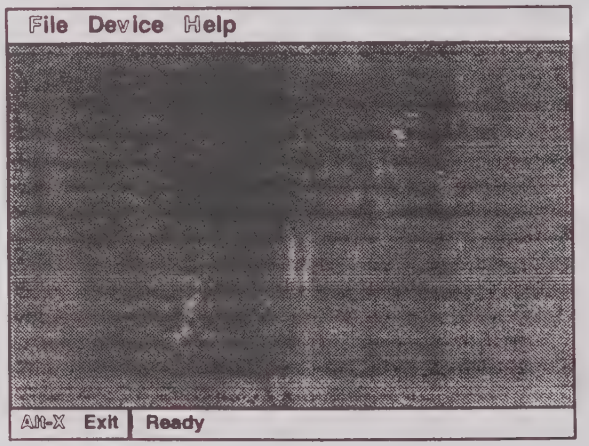
5. At the DOS prompt (C:>) make a new directory by typing **MD Wavetek** and press **ENTER**. If you do not wish to name the directory Wavetek, choose any DOS directory name desired.

6. At the DOS prompt in the Wavetek directory, type
COPY A:*.* and press **ENTER**.
When the copying is complete the screen will show the files now in the directory Wavetek as follows:

```
C:\Wavetek
            Directory of  C:\Wavetek
.           <DIR>       03-06-95  5:27a
..          <DIR>       03-06-95  5:27a
LANTKDOS EXE        278,238   01-12-95   1:22p
DATAMAN  INI             29   03-06-95   5:36a
```

7. To start the DOS Utility, type **LANTKDOS.EXE** and press **ENTER**.

The LANTEK PRO Upgrade Utility screen will appear as shown at right.



Operating LANTEK PRO Windows Utilities

If you are already familar with Windows and Database file operations the following is a quick start guide for the pull down menu commands and tool bar icons. If you are not familar with these please refer to your Windows operating manuals.

File (Alt+F) - Opens a pull down menu with the following commands:

A job must opened or created before attempting to download Autotest results. The job file provides a grouped location to store all the tests from the same work site or contract.

Open Job - Use this command to open an existing job stored in the Database files. A job selection window will open to permit drive, directory and job name selection. When the job opens, previously greyed out commands and dark icons will be bolded and available for use.

New Job - Use this command to create a job file. A job selection window will open to permit drive, directory and job name selection.

Delete Job - USE WITH CARE This command deletes the entire job file and all associated Autotest results stored under that job name. If you are using this to clear an active directory of file area be sure that a backup of this file has been made for possible later use.

Import from PRO Handset - This command downloads Autotest results from the LANTEK PRO / LANTEK PRO XL by remote control. The test results will be stored under the open job's file name and listed on screen at the completion. Make sure the following set ups are complete prior to using this command:

A. Use Configure Serial Port under Device to activate COM1 or COM2 and set the baud rate at the same rate set in the LANTEK PRO /LANTEK PRO XL. (Default = 9600).

B. A job must be open to provide a destination for the Autotest results.

C. Connect the LANTEK PRO / LANTEK PRO XL Display Handset to either the COM1 or COM2 port using the serial cable provided with your instrument.

D. Turn on the LANTEK PRO or LANTEK PRO XL and check the LCD Ready Screen for sufficient battery power.

At command execution the utility application will take control of the handset and perform all steps to dowload the Autotests. NOTE: The utility application can NOT download test results for diagnostic tests and graphs, only Autotests. Diagnostic test results and graphs have varied and in some cases more complex storage arrangements and require the use of Wavetek's CMS (Cable Management System) Software for downloading.

Export to File - Use this command to move test results to another file. Export can be used to store the results on

a floppy disk or move them to another directory. Comma separated variable (CSV) output is available from this function for inclusion of data into a spread sheet or other database program.

Print - The print command will send all, or only selected, tests to a printer for printing. The printer can be connected directly to the PC or a network printer can be selected. All set ups for the printer should be complete prior to executing the print command.

Print Setup - Opens the Windows Print Setup for the current version of Windows running on your PC.

Job Info - This calls a sub-window with detailed information about the open job. It has the entire job description at the top, drive and directory details, date the job was created, and/or modified, the customer's identification and your own company's information. The job description, customer and company information are all user entered blocks. Drive, directories, dates and test count will appear automatically.

Exit - Prompts the user on saving any changes and closes the utility application.

Settings

Length in meters
Length in feet

Test - (Alt+T) Opens a pull down menu for marking, unmarking and deleting tests as follows:

Select All - Use this command to place a check mark by all tests. This would quickly mark every test in the Job File for: Printing, Exporting or Deleting. If only certain individual tests results are desired, use the up/down arrows to locate the test and click on the left most box next to the test name or cable ID. A black "x" will appear indicating that this test is selected for action, A single mark can be removed and the test de-selected by repeating the procedure.

Unselect All - Use this command to remove all marks from tests.

> **Delete - USE WITH CAUTION** - This command will delete marked tests. If all tests are marked the entire job file contents will be erased. Before using this command be sure you have made a back-up copy of the test(s) you plan to delete.

Device (Alt+D) - Opens a pull down menu for communications commands with the LANTEK PRO / LANTEK PRO XL.

> **Configure Serial Port** - This command will open a window for the user to select from COM 1 through COM 4 and set the baud rate for communications with the LANTEK PRO / LANTEK PRO XL.

Help (Alt+H) - Opens a pull down menu with the contents of help and version information for LANTEK PRO Utilities. To leave help at any time use help's File command (Alt+F) and Exit.

> **Contents** - Provides a list of available commands and actions, and information on how to use them.
>
> **About** - Provides the version information for this software.

Using PRO Utility For Windows

Overview

The Wavetek PRO Utility is designed to make uploading reviewing and printing test results from the LANTEK PRO and LANTEK PRO XL cable tester quick and easy. LANTEK PRO Utility organizes your test data into "Jobs." A job is simply a collection of test results that you give a name to. To use the LANTEK PRO Utility follow these simple steps:

> (1) Create a new job database.
> (2) Upload test data from LANTEK PRO or LANTEK PRO XL Handset into the database. You may upload data from multiple handsets into the same

database or add autotest summary data to an existing database at any time.

(3) Use the LANTEK PRO Utility to review your test results.

(4) Select any or all tests in any combination to print a test report or export data to a file for use by other applications.

Creating a new Job

To create a new job database:

(1) Select **New Job...** from the File menu or click on the New Job icon in the toolbar.

(2) Select the drive and directory that you want your new job database to reside in.

(3) Enter a job name (up to 64 characters)

(4) Select **OK** button.

(5) Select **Job Info** from the File menu and enter your customer and user information for this job. This information will be used on printouts.

The LANTEK PRO Utility now displays an empty test result grid into which you can now import test data.

Opening an existing Job

To open an existing job database:

(1) Select **Open Job...** from the File menu or click on the Open Job button on the toolbar.

(2) Select the drive and directory that your job database is contained in. The jobs that are contained in a directory will appear in the job name box.

(3) Click on a job name and select **OK** button or double click on the job name.

The PRO Utility now displays the job you selected with all of its test data available for review in the test results grid.

Importing data from the LANTEK PRO Handset
To import Autotest data from the LANTEK PRO or LANTEK PRO XL handset to the currently open job:

(1) Open an existing job database to import your data into.
(2) Connect the LANTEK PRO or LANTEK PRO XL handset to an unused serial port on your computer using the serial cable (and DB25 adapter if necessary) provided with the LANTEK PRO.
(3) Review the serial port setup on your LANTEK PRO Handset (refer to Chapter 2). It should be set to a baud rate that your computer is capable of supporting and the DTE mode should be selected.
(4) Select **Configure Serial Port...** from the Device menu. Select the comm port that the PRO Handset is connected to and set the baud rate to be the same as the LANTEK PRO Handset. Press the **OK** button when ready.
(5) Select **Import** from LANTEK PRO Handset... from the File menu. A catalog of test results will be uploaded from the Handset and displayed for you to review.

☛ Remember the PRO Utility can only handle Autotest data formats.

☛ Fault Find diagnostic tests and graphs can not be uploaded.

(6) Select the test names that you want to import. You may select any or all tests to upload. Click on the **Import** button. Depending on the number of tests you have selected and the baud rate settings the upload process could take up to 30 minutes but will typically be less.

The import process is now completed and the imported tests have been added to the currently open job database.

Exporting data to a File

To make data available to other applications such as spreadsheet or database programs you can export test data to a text file (.csv format). You can choose any or all tests in the open job for export:

(1) Open the job database you want to export test data from.
(2) If you only want to select tests to export from a specific set of tests in your job then mark them before proceeding. If you want to export all of your tests then you do not need to mark any of them.
(3) Select **Export to File...** from the File menu.
(4) Select the drive and directory you want the export file to reside in.
(5) Enter a DOS file name (up to 8 characters) using the ".csv" extension to indicate "comma separated variable" which is a standard text file format used by database programs. Click on **OK** button.
(6) Choose **All Tests, Passed Tests,** or **Marked Tests** in the Tests Filter option box. Only the tests indicated will be displayed in the test selection grid. All tests is the default.

(7) From the test export grid check the specific tests you want to print in your report. Use the **Select All** button to select all tests currently displayed in the grid.
(8) Click on the **Export** button to complete the export of test data to a text file.

The export operation is now completed and a text file has been created with the test data you selected. You may review this file with any ASCII text editor or import this file into a spreadsheet or database program that supports .csv file formats.

Printing a Job

LANTEK PRO Utility makes it easy and quick to print test reports of your job data. You can print any or all of the tests in your job database. For example you can print only the tests that you select, only passed tests, or you can select all tests to print. Two types of report formats are available. A "brief"

report will print a summary of each test allowing approximately 4 tests per page to print. A "detailed" report will print much greater detail of information with only one test per page. Follow these steps to print a report.

(1) Open the job database you want to print test data from.
(2) If not already set up select **Print Setup...** from the File menu to select and configure the printer you will use.
(3) If you only want to select tests to print from a specific set of tests in your job then mark them before proceeding. If you want to print all of your tests then you do not need to mark any of them.
(4) Select **Print...** from the File menu.
(5) Choose **All Tests, Passed Tests,** or **Marked Tests** in the Tests Filter option box. Only the tests indicated will be displayed in the test selection grid. All tests is the default.
(6) Choose **Brief** or **Detailed** from the Autotest Format option box.
(7) From the test print grid check the specific tests you want to print in your report. Use the **Select All** button to select all tests currently displayed in the grid.
(8) Click on the **Print** button to begin printing the job report.

A "Detailed Report" corresponds directly to the summary report printed by the LANTEK. The LANTEK summary report is described in the section on **Individual Test Results**. Reporting of individual test results (pass, pass*, fail, and fail*) uses the detailed report conventions.

The LANTEK PRO Utilities Program was designed as a compliment to the LANTEK products for uploading Autotests. If you need a more powerful full service application to manage small or large volumes of cable testing records, check into our CMS software package. CMS (Cable Management System) was designed to easily upload LANTEK PRO or LANTEK PRO XL cable test results, store and print Fault Find's diagnostic test results, including NEXT, attenuation and impedance graphs, and produce highly professional cable installation and testing records. For more information about CMS mail in the product registration

card in the front of this User's Guide, ask your local distributor or call Wavetek at 1-800-223-9885.

6 | Testing & Troubleshooting

This chapter is divided into two sections:
Twisted Pair Cable and **Coaxial Cable.**
Although some of the tests are the same, the cable types and topologies they support are very different.

Below is a list containing some of the various cable types within these groups and a note if an accessory is required to make the proper commection to the LANTEK PRO / LANTEK PRO XL.

Twisted Pair Cables

Cable Type	Network	Optional Adapters
10BASE-T	Ethernet	
TIA/EIA Categories 3, 4, 5	Various	
IBM Type 1(A), 2, 6(A), 9	Token Ring	CA-IBM-PRO Adapters
Misc. 1 to 4 pair cables	Various	None if RJ-45 style connectors

Coaxial Cables

Cable Type	Network	Optional Adapters
10BASE-2 (RG-58)	Ethernet	
10BASE-5 (Thicknet)	Ethernet	BNC-N Adapters
ARCNET (RG-62)	ARCNET	
TWINAX	IBM	CA-TWINAX-PRO Adapters

See Appendix B for a complete list of cable types supported with default settings.

System Under Test

Background

Whenever an electronic test instrument is connected to a circuit to obtain a reading, that unit and its connecting cables become part of the "circuit-under-test." To some extent, the reading will always reflect the instrument's participation in the measurement. The ultimate goal has been to reduce to an absolute minimum the effects the instrument has on the circuit. This provides the user with the most reliable measurement of the circuit's parameter(s).

The new TIA standards establish methods for determining an instrument's accuracy. Wavetek, as a participating committee member, is active in defining the technical background behind the proposed standards. The LANTEK PRO and LANTEK PRO XL testers have been designed and tested to meet or exceed all proposals for these stringent new standards.

Why Wavetek uses DB-15 instrument connectors

The LANTEK PRO / LANTEK PRO XL use a DB-15 connector at the instrument for a final test lead connection. Three important factors led to our decision to omit an 8MJ (RJ-45 style) jack in our LAN cable test instruments:

(1) 8MJ/8MP connectors add significant NEXT to higher frequency measurements.

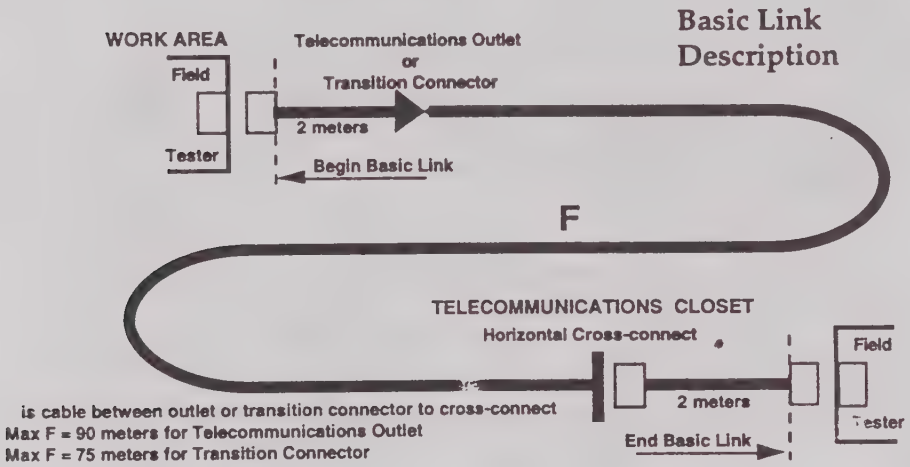
(2) TIA/EIA's proposed standards excluded the 8MJ/8MP connection from the end of the model links used to define the current LAN cable testing limits.

(3) Modular 8 connecting hardware is limited to 500-1000 mating cycles before requiring replacement. Wavetek test leads can be re-terminated in the field.

TIA and ISO Proposals for "Basic" and "Channel" Links

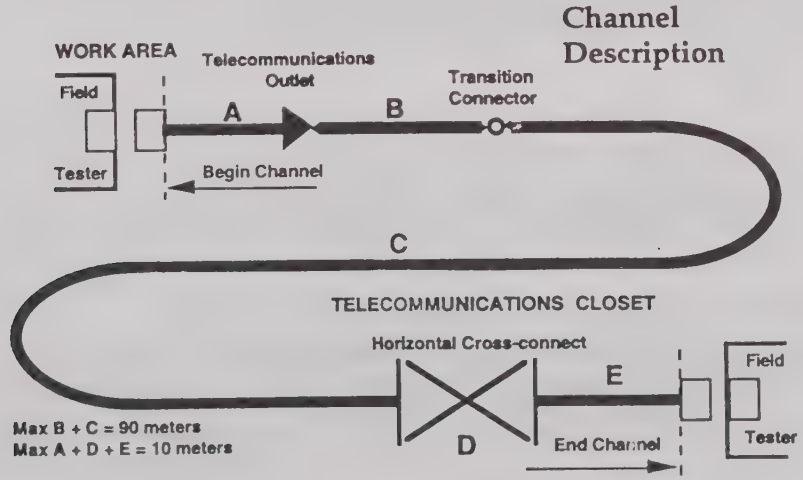
Basic Link Definition

Designed for use as a reference to the installed portion of a cabling system, the basic link consists of up to 90 meters of horizontal cabling, a connector at each end, and up to 2 meters of test equipment cord from each outlet to the respective local and remote tester components.



Channel Definition

The channel is intended to include all aspects of the cabling system. It consists of up to 90 meters horizontal cabling, a telecommunications outlet, an optional transition connection close to the work area, a maximum of two cross-connects in the telecommunications closet, patch cords, and equipment cords. Total length of all equipment and patch cords is limited to 10 meters.



Testing Twisted Pair Systems

Detailed instructions for testing procedures

Twisted pair wiring systems provide four-pair cable and connectors that allow the user to operate different network types on the same cabling plant. Although current networks use only two of the four pairs, future networks, like 100BASE-T4 will employ all four pairs to obtain higher data transmission rates. This cable and the connecting hardware must meet minimum standards for the selected category being tested (i.e., Cat. 4 at 20MHz, Cat 5 at 100MHz, Class D at 100MHz).

The TIA/EIA is currently exploring further recommendations regarding the test parameters for the type of links used. When the new recommendations are adopted, a Basic Link will be defined as 90 meters (295 feet). A Channel Link will include the Basic and add equipment cords for a maximum of 100 meters (328 feet).

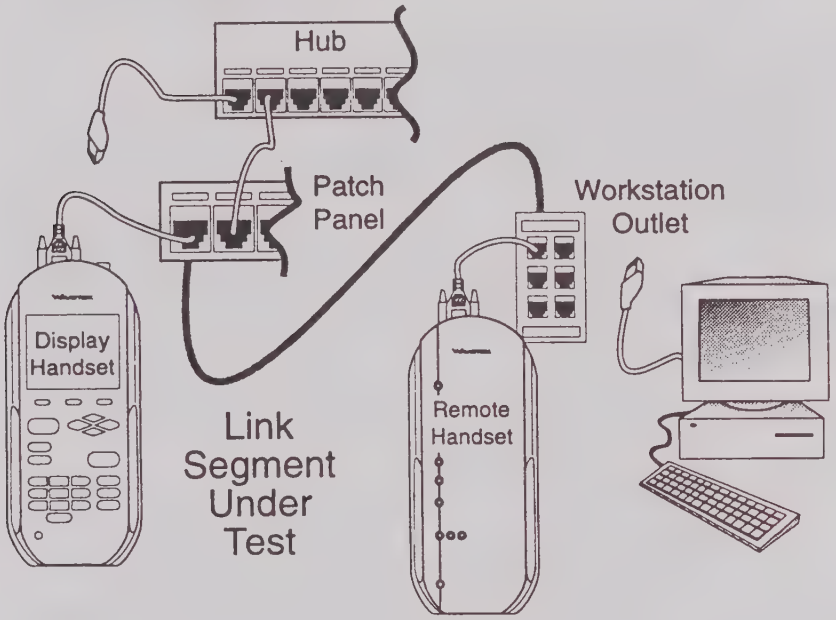
The LANTEK PRO test leads are wired T568B, but will work on both T568A or T568B. If a USOC or other wiring scheme is used, a special adapter may be required for connection. The T568B test leads will match the configuration for pair's 3,6 and 4,5, but not USOC pairs 1,8 and 2,7. These require a special adapter. Refer to Chapter 1 for full a list of available accessories. If your testing requirements include connection to a 110 connecting block, refer to the "Testing with Special Adapters" section later in this chapter.

Test Setup

Step 1. Disconnect the cable to be tested from all network equipment.

Step 2. If the LANTEK PRO has not been calibrated in the past 24 hours, perform a field calibration using the instructions in Chapter 1 section: "Calibration."

Step 3. Connect the Display Handset to one end of the segment to be tested, and connect the Remote Handset to the opposite end, as shown below.



Step 4. At the LANTEK PRO Ready screen:

A. Press the **Cable** option key **(F1)**.

B. In the Select Cable Type menu, use the **Number 3** key to select or **Arrow** keys to scroll to Twisted Pair. Press **Enter** to select.

C. In the Twisted Pair menu, use the **Number** keys to select or **Arrow** keys to scroll to the appropriate cable type. Press **Enter** to select.

To specify a manufacturer's cable type and use the manufacturer's specifications for NVP and impedance as test parameters, press the **Mfg** option key **(F2)**. An alphabetical list of manufacturers will be displayed. Use the **Arrow** keys to scroll to the manufacturer and cable to be tested. Press **Enter** to select.

To customize the test parameters for a selected cable type, press **Custom (F1)**. A menu for each test parameter will be displayed with current limit setting and space to enter the desired modification.

Use the **Arrow** or **Number** keys to select the parameter for modification. See Chapter 2 section: "Setting & Customizing Cable Types for additional assistance in modifying cable parameters.

To check and/or modify the NVP settings for the selected cable, press the **NVP (F3)** key. The **Increase (F2)** and **Decrease (F3)** keys can be used to modify the NVP. The **Measure (F1)** option key allows you to measure the NVP for the cable if it is not known.

Testing Procedure

Step 1. Press **Autotest**. Testing status is displayed while the Autotest is in progress.

Step 2. When Autotest is complete, overall pass/fail test results are displayed at the top of the display. Individual pass/fail results are displayed for each test.

Step 3. To save or print the test results, press the **SaveAs (F1)**, **Save (F2)** or **Print (F3)** option key. The **Save** key stores the results using the test ID displayed. Use SaveAs to store the test result using a different ID. If AutoSave and/or AutoPrint features were selected in the setup, this function will execute automatically when all tests pass. Failed tests will need to be saved or printed manually.

Troubleshooting Twisted Pair Systems

- *Test results that will be affected*
- *Probable causes for failing Autotests*

What to Do When Failures Occur

A failure result for Autotest indicates one or more tests did not meet minimum cable parameter levels for the cable type selected. Be sure that you have selected the correct cable type and are using appropriate connectors and links. For example, if the link was installed using Category 5 cable, but for some reason Category 4 connectors wh re used, it may fail tests for a Category 5 network. To pass testing for any specific level, Categories 3, 4 or 5, or ISO Classes C or D, all components used in the link must meet test standards for that category.

Identifying which tests failed and the characteristics of the failure will determine the type of fault. If the Autotest shows a failure on a particular sub-test, perform Fault Find for the failing test to troubleshoot.

When more than one test fails on Autotest, the test order in troubleshooting is important in eliminating the source of the problem. It is recommended that if any tests fail, trouble-shooting and corrective action be conducted in the following order:

1. Line Map
2. DC Loop Resistance
3. Length and delay
4. Mutual capacitance and average impedance
5. Attenuation
6. NEXT
7. ACR
8. Return loss

Line Map Errors

Line Map runs a pin-to-pin connectivity test for all 8 pins and the shield, if selected. The pass/fail criteria are determined by the cable type selected and includes consideration of pins

associated with the cable type. For example, TP-DDI uses only the 1,2 and 7,8 pins. If the line map test detects an open, short or miswire in the 3,6 or 4,5 pins, it will display them, but pass the Line Map test for TP-DDI.

A fault in Line Map will cause errors in other tests. Even one open pin can cause DC loop resistance and attenuation tests to fail. An open may also cause a zero or maximum capacitance reading, depending on which end of the cable it is on, and will cause false readings in NEXT tests. A failure in a line map should always be the first problem corrected, since it causes faults in other tests.

Shield Continuity Failures
Testing the continuity of the shield is important and requires shielded test leads at both the Display Handset and Remote Handset. Select shielded cable type (STP) in the Cable Type menu.

Problem: One or more open pins

Other Tests Affected
DC Loop Resistance: Fail.
Attenuation: Fail.
NEXT: Some false measurements.
Mutual Capacitance: 0 reading possible.
Length: May be low if the open is near the Display Handset.

Probable Causes
1. Broken wire(s).
2. Connector-to-wire punch down not mated.
3. Defective jack or plug.

Problem: Shorted Pins

Other Tests Affected
DC Loop Resistance: Low or zero.
Attenuation: Fail.
NEXT: Some false measurements.
Mutual Capacitance: Over limit.
Length: Reduced or shorted pairs.

Probable Causes
1. Conductors making contact at a connector.
2. Jack or plug has pin or circuit defect.
3. Cable damaged.

Problem: Miswired Pins

Other Tests Affected
Usually none, but infrequently, one or more tests may fail.

Probable Cause
Conductors reversed at a connector.

A network link or patch cable can have one type of error that will not show during a line map test. This condition is known as split pairs. The split pairs condition occurs when a single wire from one pair is crossed with a single wire from another pair at both ends of a cable or network link. The result is correct pin-to-pin conductivity, but the shared conductors cause a serious signal imbalance and very high NEXT and attenuation between the pairs involved.

DC Loop Resistance Failures

DC loop resistance testing is essential to isolating poor connector punch downs, cable damage and shorts. Loop resistance is tested for each pair by placing a known DC voltage on one wire in the pair, shorting the Remote Handset (termination end) and reading the voltage loss at the Display Handset.

All four pairs of a network link should have about the same resistance. Normally, loop resistance increases on a linear scale with the length of the network link. The loop resistance of a 200 foot link will be about twice that of a 100 foot link. The maximum limits in the default tables are based on the maximum length limit of the link or cable segment in the table, therefore, when testing a very short cable, DC loop resistance may be within limit even when there is a fault. A common fault is one pair with a very high DC loop resistance when the others are normal.

Other Tests Affected
Line Map: May fail.
Attenuation: May fail.
NEXT: May have false readings.
Mutual Capacitance: May fail.

Probable Causes
1. Poor connection points.
2. Cable damage.

Length and Delay Failures

Length failures are not common because most installed network links are far below the twisted pair maximum of 328 feet (100 meters). However, measured length can sometimes differ from known cable length. The reason is that jacket length, the measured length of the cable when it is cut from the reel, can differ from electrical length, which is the length obtained by time domain reflectometry (TDR) or other signal analysis of the cable.

When measured cable length varies from actual length, a problem exists. Since cable testers use electrical length calculated using time domain reflectometry (TDR) or other signal analysis methods to determine length, an incorrect length measurement indicates a problem in the cable conductivity.

Electrical length between pairs in the same cable can also vary. Normally, there should only be a slight difference. If the variation is more than 10%, it could indicate a potential problem. Since there is a direct relationship between NVP and mutual capacitance, an elevated capacitance on any pair can cause that pair's length to appear greater.

Other Tests Affected
DC Loop Resistance: May be slightly high or fail.
Attenuation: May be slightly high or fail.

Probable Causes
1. Too much cable installed.
2. Incorrect NVP.
3. Installed matched terminator not functioning correctly.
4. Cable insulation damage to longer pairs.
5. Near open or near short condition on shorter pairs.

Mutual Capacitance and Average Impedance Failures

Mutual capacitance is a measurement of the dielectric constant between conductors in the twisted pair. It is divided by the length of the cable to provide a picofarad per foot (meter) reading.

Small changes in the capacitance measurements are normal due to the handling of the cable during shipping and installation. The addition of connectors and patch cables will also affect total dielectric value. In a coaxial cable the dielectric constant is extremely important to maintain the speed of the cable (NVP) and minimize signal distortion. When capacitance exceeds the maximum limit, it causes network communications problems.

Other Tests Affected
Length: Affected pairs will appear longer.
TDR Impedance Plot (LANTEK PRO XL only): May show a downward distortion point at spot of damage.
Attenuation: May increase.
Average Impedance: Change in average impedance is inversely proportional to change in capacitance.

Probable Causes
1. Compression, stretching, or excessive bending damage to the cable.
2. Defective connectors.
3. Insulation damage at a connector.
4. Ground loops created between cable shielding (if used) and equipment grounding (via RS-232 cable to computer, or auxillary power).
5. Improperly chosen cables or patch cords.

Attenuation Failure

Attenuation is the loss in amplitude or strength of a signal as it travels from the signal source. Attenuation is measured by injecting a signal of known amplitude at the Remote Handset and reading the amplitude at the Display Handset.

The reference for the injected signal is 0 dB, and loss in amplitude is expressed in negative dBs (-dB) relative to the reference. The negative sign is dropped when reporting readings, so a reading of 20 dB is actually -20dB and indicates a weaker signal than a reading of 10dB.

The LANTEK PRO sweeps the frequency range selected at specific frequency steps to ensure complete testing coverage. In a twisted pair system, each pair is swept to 16 MHz (Cat 3), 20 MHz (Cat 4) or 100 MHz (Cat 5), depending on the cable type selected. The worst case is normally at the highest frequency. The attenuation graph will show the loss increase over the frequency band.

It is possible to pass Attenuation, but receive a marginal pass (pass*) due to an "Atten/length" overlimit. The Atten/length value in the test report is a metric derived from the ratio of maximum allowed attenuation for the cable type and the maximum allowable length. This value is compared with the value obtained by dividing measured attenuation by measured length for a given cable run. If this value is greater than the metric, then the cable has too much attenuation for its measured length, even though the attenuation itself may pass. Usually, this is an indication that the NVP value set into the tester is too small and the tester is reporting too short a length.

Other Tests Affected
DC Loop Resistance: May be high.
Mutual capacitance: May be high.
Length: May be overlimit.
NEXT: May be low on pair combinations.
Average Impedance: May be low.
Return Loss: May be overlimit.

Probable Causes
1. Installed cable or patch cables not appropriate for the Category rated.
2. Worn connectors.
3. Poor punch-down connection.
4. Length overlimit.
5. Split pairs.
6. NVP set too low.

NEXT Failures

Near-end crosstalk (NEXT) is the signal induced from a transmitting pair to an adjacent pair in the same cable sheath. NEXT is measured by applying a signal of known strength to one pair (referred to as the disturbing or source pair) and reading the amount of signal induced in each of the other pairs in the cable. Signal amplitude at the point of injection is measured and used as the 0 dB reference. NEXT is measured in -dB in relation to the 0 dB reference. The negative sign is dropped by industry convention, so a reading of 20 dB is less near-end crosstalk than 10 dB.

Other Tests Affected
Return Loss: May be overlimit.

Probable Causes
1. Installed cable or patch cable not 10BASE-T rated.
2. Defective, poor quality cable or too many connectors.
3. Poor quality installation at the connection points.
4. Split-pairs.

ACR (Attenuation to Crosstalk Ratio) Failure
ACR is not an independent test, but a calculated ratio based on attenuation and NEXT results for each cable pair. ACR is the difference between the worst case NEXT and the worst case attenuation for each pair. Since ACR indicates the signal strength in relation to the noise on the cable, a larger decibel value is better.

In most cases the attenuation for a well constructed network link will be well above the maximum attenuation permitted. Even if NEXT is close to the limit, this still leaves a sufficient ACR margin for proper network operation.

Other Tests Affected
Attenuation: May fail.
NEXT: May fail.

Probable Causes
Combination of attenuation and NEXT causes previously discussed.

Return Loss Failure
During the NEXT test, a certain level of signal is transmitted from each end of each pair. Most of this signal level is transmitted down the pair and reaches the other end, weakened by the amount of signal attenuation in the wires. Some transmitted signal is reflected back to the transmit end by impedance mismatches. Return loss is the measure of reflected to transmitted signal strength. Good quality cable runs will have a low value of reflected signal, indicating good impedance match in the run's various components.

A high dB value indicates a good cable run, whereas a low dB value of 10 dB or less indicates significant signal loss. Again, the industry convention is to drop the minus sign in front of the dB value for return loss.

Other Tests Affected

Attenuation: May be high.

Capacitance and Average Impedance: Could be affected if the impedance mismatch is caused by cable damage.

DC Loop Resistance: May be high if due to a poor punch-down.

Probable Causes

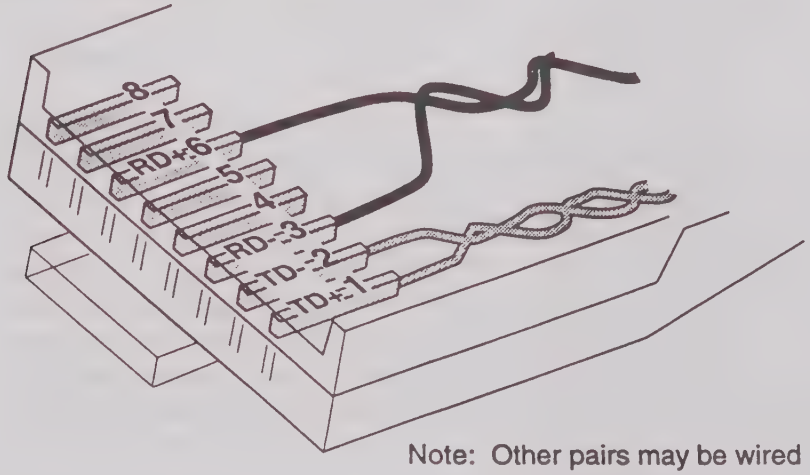
1. Installed cable or patch cord has improper characteristic impedance.
2. Damaged or worn connectors.
3. Damaged cable.
4. Poor punch-down.
5. Insufficient length of cable or patch cord between two connectors can cause a resonance.

Testing 10BASE-T Cabling

10BASE-T Ethernet systems use twisted pair cabling for transmission of network data frames. Both the cable and connecting hardware must meet minimum standards, as specified in IEEE 802.3. The default settings for 10BASE-T network links in the LANTEK PRO reflect those standards.

10BASE-T systems use the 1,2 and 3,6 pins for transmit and receive, respectively, as shown in figure 6-1. The LANTEK PRO passes or fails the line map based on this pin configuration. If your system does not use the IEEE 802.3 wiring standard, a custom adapter is required to align nonstandard transmit and receive pairs.

8MP (RJ-45 Style) Connector



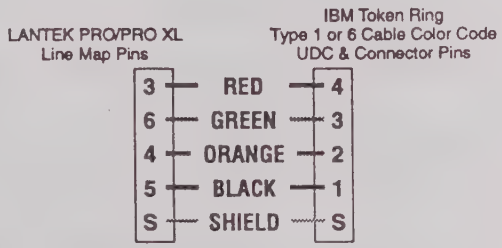
Note: Other pairs may be wired but 10BASE-T uses only the pairs shown.

Testing Token Ring Cabling

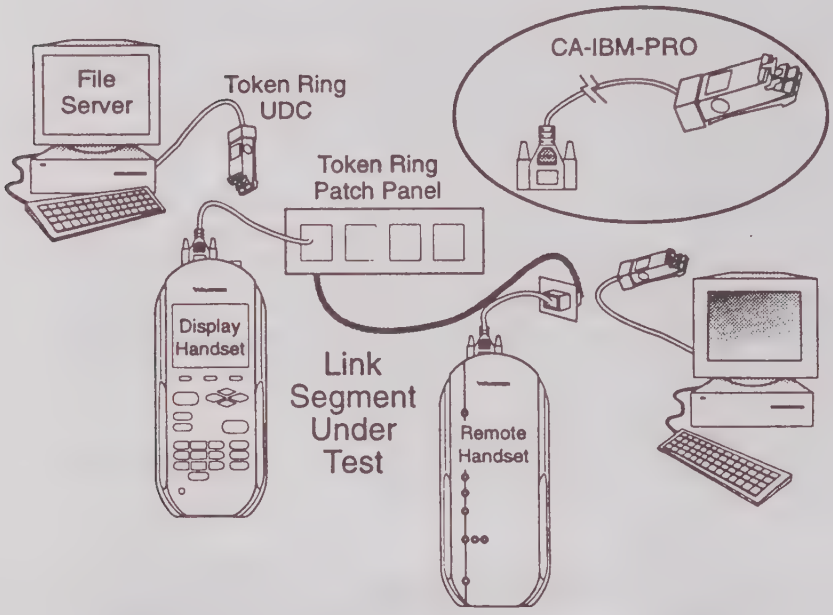
Token Ring Cabling uses two-pair cable and connectors, shielded and unshielded for network data transmission. The cable and connectors for Shielded Token Ring systems are very different from those used in 10BASE-T and Structured Wiring Systems. The default settings for each type of Token Ring network in the LANTEK PRO are based on maximums for cable and connectors listed in IEEE 802.5.

The LANTEK PRO requires the use of special adapters for connection to IBM Universal Data Connectors (UDC). The adapter test leads, Part Number *CA-IBM-PRO*, are shown attached to the Display and Remote Handsets in the figure on the next page. When connected to a properly wired Token Ring network link, they will return the proper line map. The LANTEK PRO uses the pairs 3,6 and 4,5 to map the two-pair system.

If a shielded system is being tested, line map will also show the shield continuity. The figure at right shows the pin/pair numbers to Token Ring color coded wires.



When selecting the Token Ring cable type, be sure to select shielded or unshielded to ensure the parameters are correct.



Testing With Special Adapters

- *Testing with 110 connecting block adapters*
- *Testing with installed patch cable adapters*
- *Testing with Twinaxial cable adapters*
- *Testing with custom made adapters*

Testing with 110 Connecting Block Adapters
At times it is necessary to test directly from a 110 connecting block to either a patch panel or office outlet. There are two types of adapters that can be used with the LANTEK PRO: the Wavetek CA-110-PRO supports testing up to 100 MHz and a commercially available 8MJ (RJ-45 Style)-to-110 block adapter can be used to support testing requirements to 20 MHz (Category 4).

Use a T568-A or T568-B adapter test lead to replace one of the test leads supplied with the LANTEK PRO. Usually this test lead is connected to the Display Handset, however if required, it can be connected to the Remote Handset. Connect the other handset using one of the test leads supplied with your tester.

Note the line map results on the first test carefully. If the line map fails, it may indicate a reversal between T568-A and T568-B wiring standards. Try replacing the adapter test lead with the opposite lead and the link should map correctly.

Testing with Installed Patch Cable Adapters
The test leads supplied with the LANTEK PRO are designed for the most common testing requirement, installed building cables. When network patch cables are used, an adapter test lead set should be used to connect directly to the patch cable. The Wavetek CA-8MJ-PRO, is designed for testing twisted pair cabling up to TIA/EIA Category 5 and is specifically designed with a DB-15 male connector for direct connection to the Display and Remote Handsets. The other end of the adapter has an 8MJ (RJ-45 style) jack for patch cable 8MP plugs. The adapters come as a set with one adapter lead for the Display Handset and one for the Remote Handset. However, if only one end of a network link has the installed patch cable, these adapters work in conjunction with a regular test lead attached to the opposite handset.

Testing with Custom Made Adapters

Occasionally, testing is required on cable systems that are wired differently than the popular pairing configurations standardized by TIA/EIA's T568-A or T568-B. Special adapters can be made if not commercially available.

All cable and components in a custom test adapter should equal or exceed the minimum standards for the link they test. If you attempt to test a Category 5 link with a custom adapter containing a Category 4 plug or cable, it will cause failures. Even if the link passes the Category 5 testing, the readings will not be representative of the actual link quality.

The LANTEK PRO tests twisted pair cable in specific pairing as: pins 1,2 3,6 4,5 and 7,8. When using an adaptor, be sure the alignment is correct. Compare the wiring schemes for T568A or B and USOC, as shown below:

T568 A or B Pairs	USOC Pairs
1,2	1,8
3,6	3,6
4,5	4,5
7,8	2,7

Test results for the 3,6 and 4,5 pairs will be normal, but USOC's 1,8 and 2,7 will be out-of-limit since the pair alignment is incorrect. It should be noted that if only the 3,6 and 4,5 pair are tested, and the connectors are 8MJ (RJ-45 style), no adapter is required. Use the test leads supplied with the LANTEK PRO.

Please call Wavetek Applications support at (800) 854-2708 ext. 511 if you need assistance fabricating custom adapters.

Testing 10BASE-2 Cabling

Detailed instructions for testing procedures

10BASE-2 Ethernet systems usually use RG-58 coaxial cabling for transmission of network data frames. This cable and the connecting hardware must meet minimum standards for 10 MHz Ethernet as specified in IEEE 802.3. The default settings for 10BASE-2 in the LANTEK PRO reflect these limits.

Test Setup

Step 1. Disconnect all coax T-connectors from any LAN equipment on the network cable segments designated for testing. The T-connectors should be left in place on the cable.

Step 2. If the LANTEK PRO has not been calibrated in the past 24 hours, perform a field calibration using the instructions in Chapter 1: Calibration.

Step 3. At the LANTEK PRO Ready screen:

A. Press the **Cable** option key **(F1)**.

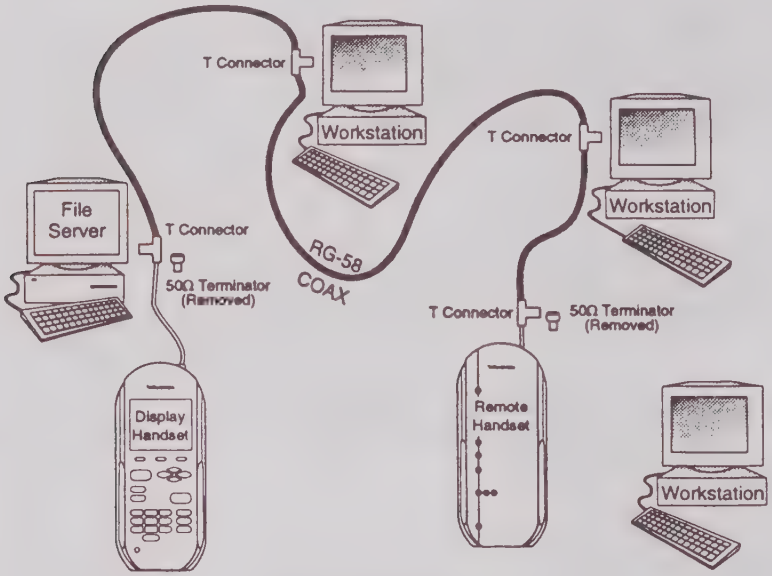
B. In the Select Cable Type menu, press **Enter** to select "Ethernet."

C. In the Ethernet menu use the **Number 2** key to select or **Arrow** keys to scroll to "10BASE-2."

To specify a manufacturer cable type and use the manufacturer's specifications for NVP and impedance as test parameters, **Select Mfg P.N.** option key **(F2)**. An alphabetical list of manufacturers will be displayed. Use the **Arrow** keys to scroll to the manufacturer and cable to be tested. Press **Enter** to select.

To customize the test parameters for a selected cable type, press **Custom (F1)**. A menu for each testing parameter will be displayed. Use the **Arrow** or **Number** keys to select the parameter for modification. Each cable parameter has a screen with current limit setting and space to enter the desired modification. See Chapter 2 section: "Setting & Customizing Cable Types" for additional assistance in modifying cable parameters.

Step 4. Connect the Display Handset to one end of the RG-58 coax link segment to be tested and connect the Remote Handset to the opposite end of the segment as shown below. Use the BNC connector on both handsets.



Testing Procedure

Step 1. Press **Autotest**. Testing status is displayed while the Autotest is in progress.

Step 2. When Autotest is complete, overall pass/fail test results are displayed at the top of the display. Individual pass/fail results are displayed for each test.

Step 3. To save or print the test results, press the **SaveAs (F1)**, **Save (F2)** or **Print (F3)** option key. The Save key stores the results using the test ID displayed. Use SaveAs to store the test result using a different ID. If Auto Save and/or Auto Print features were selected in the setup, this function will execute automatically when all tests pass. Failed tests need to be saved or printed manually.

Troubleshooting 10BASE-2 Cabling

- *Test results that will be affected*
- *Probable causes for failing Autotests*

What to Do When Failures Occur

A failure result for Autotest indicates one or more tests did not meet minimum cable parameter levels for a 10BASE-2 cable installation. Identifying which tests failed and the characteristics of the failure will determine the type of fault.

Run Fault Find on the failed test to troubleshoot. Fault Find performs continuous mode testing that allows you to make adjustments and correct the fault. When the diagnostic test in Fault Find passes, then the cable should pass an Autotest.

When more than one test fails on Autotest, the test order in troubleshooting is important in eliminating the source of the problem. It is recommended that any failed tests be conducted in the following order to troubleshoot:

1. DC Loop Resistance
2. Mutual capacitance
3. Length
4. Attenuation

DC Loop Resistance Failures

DC loop resistance testing is vital to isolating faulty connectors, poor barrel or T-connector matings, cable damage and locating shorts and opens. DC loop resistance is tested by placing a known DC voltage on the center conductor, shorting the center conductor to the shield at the Remote Handset (termination end) and reading the voltage loss at the Display Handset.

When testing shorter cables, you may need to adjust the allowable limit, since loop resistance increases on a linear scale to length, and the default test parameters in the LANTEK PRO are based on maximum cable length.
High and low loop resistance indicate different problems. Following are some examples of common cable fault problems and troubleshooting hints.

Problem: DC Loop Resistance Too High

Other Tests Affected
Impedance: May fail.
Attenuation: May be high or fail.

Probable Causes
1. Poor barrel or T-connector connection points.
2. Defective cable end connector.
3. Defective barrel or T-connector.
4. Cable damage.

Problem: DC Loop Resistance Too Low

Other Tests Affected
Capacitance: Reading can not be obtained.
Attenuation: May fail completely.
Impedance (PRO XL only): Will show the cable shorter than expected.

Probable Causes
1. Short between center conductor and shield at a connector.
2. Cable damaged, shorting center conductor to shield.

Length Failures

Length failures are common in 10BASE-2 networks. They are usually caused by moves, additions or changes to the network. Unless each segment length is carefully documented, segments added later may exceed the maximum permitted length of 607 feet or 185 meters.

When measured cable length varies from known cut jacket length, a problem exists. Since cable testers use electrical length calculated using time domain reflectometry (TDR) or other signal analysis methods to determine length, an incorrect length measurement indicates a problem exists in the conductivity of the cabling.

Other Tests Affected
DC Loop Resistance: May be slightly high or fail.
Attenuation: May be slightly high or fail.

Probable causes
1. Two segments patched together are overlimit.
2. Incorrect NVP.
3. Installed matched terminator at far end.
4. Remote Handset not found.

Mutual Capacitance Failures

On coaxial cable, mutual capacitance is measured between the center conductor and the shield. The reading is obtained by measuring the total cable capacitance and dividing by the length measurement to provide a picofarad per foot (meter) reading.

Small changes in the capacitance measurements are normal and caused by the handling of the cable during shipping and installation. The addition of connectors and patch cables also affects capacitance. When capacitance exceeds the maximum limit, it causes network communications problems.

Other Tests Affected
Length: May be overlimit.
Impedance: Overlimit reading at the problem spot.
Attenuation: May be high.

Probable Causes
1. Compression, stretching, or excessive bending damage to the cable.
2. Defective barrel or T-connectors.
3. Connector installation flaws.

Attenuation Failures

Attenuation is the loss in amplitude or strength for a signal as it travels away from the signal source. Attenuation is measured by injecting a signal of known amplitude at the Remote Handset and reading the signal's amplitude at the Display Handset.

The reference for the injected signal is 0 dB, and loss in amplitude is expressed in negative dBs (-dB) relative to the reference. The negative sign is dropped when reporting

readings, so a reading of 20 dB is actually -20dB and indicates a weaker signal than a reading of 10dB.

The LANTEK PRO sweeps the frequency range selected at specific frequency steps to ensure complete testing coverage. On a 10BASE-2 segment, attenuation is measured from 1 MHz to 10 MHz.

Other Tests Affected
DC Loop Resistance: May be high.
Mutual Capacitance: May be high.
Length: May be overlimit.

Probable Causes
1. Installed cable or patch cables are not 10BASE-2 quality.
2. Defective barrel or T-connector connection.
3. Defective cable end connector attachment.
4. Length is overlimit.

Testing 10BASE-5 Cabling

Detailed instructions for testing procedures

10BASE-5 Ethernet systems use a double-shielded coaxial cable for transmission of network data frames. This large diameter cable will have N-Type coaxial connectors at the ends and use taps along the length of the cable to connect network equipment. Both the cable and the connecting hardware must meet minimum standards for 10 MHz Ethernet as specified in IEEE 802.3. The default settings for 10BASE-5 network links in the LANTEK PRO reflect those limits.

Test Setup

Step 1. Ensure all cable taps are disconnected at the NIC cards and/or have power removed. **Note: If even one tap has power applied, the test results will reflect errors.**

Step 2. Disconnect the 50 ohm terminators from the ends of the cable segments to be tested.

Step 3. Install the BNC-N cable adapters (optional accessory) on ends of the coaxial cable.

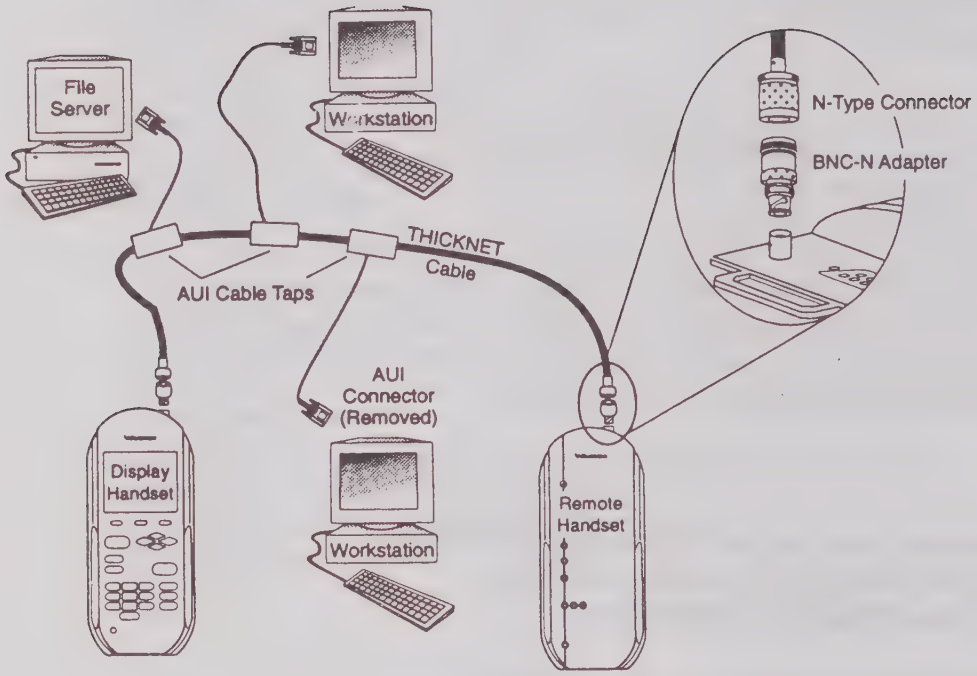
Step 4. At the LANTEK PRO Ready screen:

A. Press the **Cable** option key.

B. In the Select Cable Type menu, press **Enter** to select "Ethernet."

C. In the Ethernet menu press the **Number 3** key or use the **Arrow** keys to scroll to "10BASE-5."

Step 5. Connect the Display Handset to one end of the coax cable segment to be tested and connect the Remote Handset to the opposite end of the segment. Use the BNC connector on both handsets, as shown on next page.



Troubleshooting 10BASE-5 Cabling

Testing and troubleshooting for 10BASE-5 coax is the same as for 10BASE-2 and many of the same problems have the same causes. One important difference is the station connection method. The non-invasive AUI taps on a 10BASE-5 coax cable can cause problems, particularly shorts between the shield and the center conductor. Use the troubleshooting methods in the prior section to help isolate any problems.

Testing Twinaxial Cable

Background

Twinaxial, commonly called twinax, derives its name from having two conductors inside a braided shield. Testing this cable is similar to 10BASE-2 with some important differences. First the topology for twinax cable is different. Used mostly in IBM systems it is often daisy-chained through terminals. One leg will go in the terminal and the continuation of the leg to other terminals will come out on an adjacent plug. The last connection in this daisy-chain for terminals will have a 100 Ohm termination installed. Testing can be accomplished on the segment with the terminals connected, but the termination must be replaced with the Remote Handset for an autotest, or left open for basic length measurement.

Procedures

Step 1. Ensure all segments to be tested are disconnected at the terminals or the terminals are powered down during testing.

Step 2. Disconnect the 100 Ohm terminators from the ends of the cable segment(s) to be tested.

Step 3. Install the CA-TWIN-PRO cable adapters (optional accessory) on ends of the twinax cable

Step 4. At the LANTEK PRO Display Handset, setup for testing TWINAX cable type as follows:

A. Press **SETUP** key.

B. In the SETUP MENU choose **1. Select Cable Type** either by pressing the **(1)** key or move the highlight cursor with the **up/down arrow** keys to select and press **ENTER**.

C. In the Select Cable Type Menu, select **4. Misc. Types**

D. Then select **6. Twinaxial**.

The Display Handset will respond with a confirmation selection LCD display, escape the Cable Type Menu and stop at the Select Cable Type Menu.

Step 5. Press **Autotest**.

The tests run are:

- DC Loop Resistance
- Capacitance
- Length
- Attenuation

If the Autotest result is PASS, then the cable meets all minimum requirements to operate. If a failure is encountered, use Fault Find and procedures in the 10BASE-2 (coax) section of this chapter to troubleshoot the problem. In using these procedures remember that twinax has two interior conductors and that test results are applicable to those two conductors, whereas in 10BASE-2 the test results are between the single conductor and the shield.

For more information concerning testing and troubleshooting refer to the *Handbook of LAN Cable Testing*.

7 Customer Service & Warranty

Service in the U.S.A.

For technical assistance or service questions in the U.S.A., call Wavetek at 1-800-854-2708.

The LANTEK PRO and LANTEK PRO XL may require annual calibration to meet accuracy specifications. Before returning a unit for calibration or service, call Wavetek Technical Support at 1-800-854-2708 or 619-279-2955.

If cleaning is required, use a soft cloth and mild cleaner suitable for plastic. Do not immerse in water.

When returning a unit for service or calibration, please provide the following:

(1) Customer name, company, address, telephone number, proof of purchase (for warranty repairs), and a description of the service required. Use the guidelines below to repack the unit with commercially-available materials, if the original packing materials are not available:

(2) Pack in soft carrying case, hard-sided carrying case or wrap the instrument in heavy paper or plastic.

(3) Use a strong shipping container. A double-walled carton of 250-pound test material is recommended.

(4) Use a layer of shock-absorbing material 70 to 100 mm (3 to 4 inches) thick around all sides of the instrument to provide firm cushioning and to prevent the unit from moving inside the container.

(5) Seal the shipping container securely.

(6) Ship prepaid to: Wavetek Corporation
9045 Balboa Avenue
San Diego, CA 92123
ATTN: Instrument Repair/Service

Return shipping to the customer within the domestic U.S.A. will be paid by Wavetek Corporation.

Service Outside the U.S.A.

For technical assistance or service questions outside the U.S.A., call your local distributor.

The LANTEK PRO and LANTEK PRO XL may require annual calibration to meet accuracy specifications. Before returning a unit for calibration or service outside the U.S.A., contact your local distributor or one of the Wavetek Corporation offices listed below. If your local distributor does not have a service facility, they will provide assistance in returning the LANTEK PRO or LANTEK PRO XL to an authorized Wavetek service facility.

If cleaning is required, use a soft cloth and mild cleaner suitable for plastic. Do not immerse in water.

Asia Pacific
Tel: (852) 2788-6221
Fax: (852) 2788-6220

Europe
Tel: (44/1243) 531323
Fax: (44/1243) 780382

Germany
Tel: (49/89) 99641-0
Fax: (49/89) 99641-160

South America
Tel: (619) 279-2955
Fax: (619) 627-0130

Southeast Asia
Tel: (65) 356-2522
Fax: (65) 356-2553

United Kingdom
Tel: (44/1384) 442-394
Fax: (44/1384) 440-252

Web and Bulletin Board Services

Download the latest version upgrades, cable test application notes, Q&A forum, and product announcements.

Wavetek provides both a World Wide Web (WWW) and bulletin board service for LAN cable test products that allows you to use a pc and modem to obtain the latest information on cable test application notes or firmware version upgrades. A question and answer forum allows you to share information with other users and query Wavetek product managers.

You can download the latest firmware upgrades for your LANTEK PRO or LANTEK PRO XL using a PC computer. To contact the bulletin board service, use modem access line **(619) 627-0133**.

Upgrade files are available on the World Wide Web at **ftp://www.wavetek.com**. Look in the public directory (Pub) for the list of available upgrades and download those you desire. Be sure to read all the "xx README.1ST" files before performing any upgrades.

Wavetek Corporation Standard Warranty Policy

Wavetek warrants that all Products manufactured or procured by Wavetek conform to Wavetek's published specifications and are free from defects in materials and workmanship for a period of one (1) year from the date of delivery to the original Buyer, when used under normal operating conditions and within the service conditions for which they were designed. This warranty is not transferrable and does not apply to used or demonstration products.

The obligation of Wavetek arising from a Warranty claim shall be limited to repairing, or at its option, replacing without charge, any assembly or component (except batteries) which in Wavetek's sole opinion proves to be defective within the scope of the Warranty. In the event Wavetek is not able to modify, repair or replace nonconforming defective parts or components to a condition as warranted within a reasonable time after receipt thereof, Buyers shall receive credit in the amount of the original invoiced price of the product.

Wavetek must be notified in writing of the defect or nonconformity within the Warranty period and the affected Product returned to Wavetek's factory, designated Service Provider, or Authorized Service Center within thirty (30) days after discovery of such defect or nonconformity. Buyer shall prepay shipping charges and insurance for Products returned to Wavetek or its designated Service Provider for warranty service. Wavetek or its designated Service Provider shall pay costs for return of Products to Buyer.

Wavetek shall have no responsibility for any defect or damage caused by improper storage, improper installation, unauthorized modification, misuse, neglect, inadequate maintenance, accident or for any Product which has been repaired or altered by anyone other than Wavetek or its authorized representative or not in accordance with instructions furnished by Wavetek.

THE WARRANTY DESCRIBED ABOVE IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND NO OTHER WARRANTY, WHETHER WRITTEN OR ORAL, EXPRESSED OR IMPLIED BY STATUTE OR COURSE OF DEALING SHALL APPLY. WAVETEK SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NO STATEMENT, REPRESENTATION, AGREEMENT, OR UNDERSTANDING, ORAL OR WRITTEN, MADE BY AN AGENT, DISTRIBUTOR, OR EMPLOYEE OF WAVETEK, WHICH IS NOT CONTAINED IN THE FOREGOING WARRANTY WILL BE BINDING UPON WAVETEK, UNLESS MADE IN WRITING AND EXECUTED BY AN AUTHORIZED REPRESENTATIVE OF WAVETEK. UNDER NO CIRCUMSTANCES SHALL WAVETEK BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, EXPENSES, OR LOSSES, INCLUDING LOSS OF PROFITS, BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Glossary

Common Industry Terms

ATTENUATION - Degradation of signal level along the cable due to losses in the cable. Attenuation is typically measured in decibels.

AUI - Attachment unit interface. Most often used with 10BASE5 networks, this is the name for the 15 pin cable which connects a transceiver to the network interface card (NIC) in the node.

AVERAGE IMPEDANCE - The ratio of voltage to current at the frequency of LAN applications. Average impedance has no direct relationship to the DC loop resistance, although both values are given in ohms. Average impedance of each pair should be equal to the LAN system impedance of 100 Ω, 120 Ω or 150 Ω, plus or minus 15 Ω.

AWG - American wire gauge. A method for measuring the thickness of the conductive portion of a piece of metallic cable. The numbers assigned are inversely proportional to the cable's size. A cable with a rating of 24 AWG will be much thinner than one rated 18 AWG.

BACKBONE - A term used to describe the main segment connecting several smaller subnetworks. This main segment is usually designed for maximum data throughput, sometimes at significantly higher speeds than the subnets.

BALUN - A passive line matching transformer designed to match the impedance of the transmission medium with that of the communicating device. Frequently used to implement communications on twisted pair media that would normally require coaxial cable.

BANDWIDTH - The range of electrical frequencies that an electronic device or transmission system can effectively handle. For LAN's, it describes the maximum data rate for a given topology.

BASEBAND - The use of the entire bandwidth of the network cable to transmit a single digital signal.

BASIC LINK - The building installed segments of a "Channel Link." Per TIA/EIA's TSB-67 the Basic Link runs from the last patch panel attached to the building's installed wiring to the office outlet jack serviced by that patch panel position. The maximum

distance is defined as 90 meters (295 feet). Per ISO the Basic Link includes all of the TSB-67 link and a second patch panel with a maximum 5 meter (16 feet) interconnecting patch cable.

BAUD - The most basic unit of data transmission speed, one baud, represents one signal state change per second. It is often confused with bits per second (bps).

BBS - Bulletin Board Service.

BNC - The Bayonet-Neill-Concelman connector. Widely used in 10BASE2 and other thin coaxial applications.

BRAID - The stranded shield found on most types of axial metallic media and some types of twisted pair, such as IBM type 1.

C-DTE - Character mode data terminal equipment. Used to describe asynchronous communications equipment such as terminals, personal computers, and remote printers, etc.

CABLE - Metallic or fiber optic transmission medium used to interconnect electrical and data communications devices. Common metallic types used in LAN interconnects are axial (coaxial, twinaxial, triaxial, quadraxial), shielded twisted-pair (STP), and unshielded twisted-pair (UTP). Cable comes in many varieties and ratings for particular applications.

CABLE RISER - Vertically installed cable connecting floors of a building. Typically multi-pair.

CABLE RUN - A given installed cable segment with its unique path.

CABLE SHIELD - A conductive layer of material located just under the cable's outer sheath which is designed to increase the cable's immunity to outside interference. It may be constructed of metal foil or braided strands.

CATV - Community antenna television or cable television.

CDDI - Copper distributed data interface. An emerging method describing 100 Mbps data transmission on metallic cable.

CHANNEL LINK - Term used to define an entire network link between equipment including the patch cables. For testing purposes this is a 100 meter (328 ft) maximum segment. Applies to both TIA/EIA and ISO link definitions.

CHARACTERISTIC IMPEDANCE - The measure of a transmission medium's impedance throughout its length and over a swept frequency spectrum.

COAXIAL CABLE - A cable constructed of an insulated center conductor surrounded by a shield.

CONNECTING BLOCK - An interconnecting device used in telecommunications and LAN applications consisting of multiple points for wire attachment. Some common connecting blocks are the "66" block from Western Electric, the "110" blocks from AT&T, and the "BIX" block from Northern Telecom.

CONTRACTOR LINK - See BASIC LINK.

CROSS-CONNECTION - Linking two physically different connections together.

CROSSTALK - The tendency for a signal on a pair of wires to be induced into an adjacent pair.

CTS - Clear to send.

DB - Actually dB, or decibel. A unit of measurement to compare an output signal to an input signal. A relative term. See also text on ATTENUATION for more information.

DC - Direct current. A steady state voltage, either positive or negative with respect to ground, but not both. Batteries are a source of DC.

DCE - Data communications equipment.

DELAY - The period of time for a signal applied to one end of a cable run to reach the other end. Measuring the delay does not require that the nominal velocity of propagation (NVP) of the cable be known.

DRAIN WIRE - An uninsulated wire in a cable included in the sheath with the insulated wires. Typically used for grounding.

DROP CABLE - A cable connecting a workstation or peripheral to the main network cable.

DTE - Data transmission equipment.

EDC - Enhanced Data Connector. A shielded 2-pair Token Ring connector with planned operation above 16MHz.

EIA - Electronic Industry Associates. A trade organization of

manufacturers which sets and defines standards for its members. This group works with the TIA on standards pertaining to both industries. The originator of the "RS" series of interfaces (RS-232C, RS-449, etc.)

EMI - Electro-magnetic interference.

FARAD - A unit for measuring capacitance. In cable testing the measurement is reported as pF per unit of length. See picoFarad.

FAR-END CROSSTALK - The inductance of a transmitted signal onto other pairs in a sheath as measured at the cable end opposite from the applied signal.

FIRMWARE - Devices such as EPROM's, and ROM's which are hardware, but permanently store operating instructions for a processing device.

FREQUENCY - The rate at which an electrical current alternates, usually measured in Hertz, or cycles per second.

GROUND LOOP - This occurs when a segment is grounded at more than one point. It creates a situation for a potential voltage difference between the grounds, causing the network cable to conduct unwanted electricity.

HERTZ - An equivalent to cycles per second for defining frequency.

IDC - Insulation displacement connector. A type of connector in which the insulated wire is pushed down between two sharp blade-like pieces of metal so that the conductor touches the connector and there is no exposed bare wire. Modular telephone plugs (RJ series) are examples of insulation displacement connectors.

IDF - Intermediate distribution frame. Also known as a wiring closet, the IDF is a cross connection point for horizontally attached devices to riser media. Provides the wiring interface between the end-user and the main distribution frame.

IEEE - Institute of Electrical and Electronic Engineers. A standards setting and publishing body responsible for such guidelines as the 802 series for LAN's.

IEEE 802.X - Guidelines describing the physical and data link layers of the OSI network model for various topologies.

IMPEDANCE - The complex opposition to current flow dynamically in a transmission medium. Including components of resistance, capacitance, and inductance.

IMPEDANCE MATCHING - The verification that all elements of a transmission system exhibit very similar impedance characteristics at operating frequency. A properly impedance matched system introduces very little signal distortion.

IMPULSE NOISE - Intermittent, high frequency (short duration), high amplitude pulses that are induced into a transmission line. Can cause data corruption and in some cases hardware damage.

INDUCTANCE - The tendency for an electrical current to build a magnetic field around a conductor and cause a portion of that current to be induced or generated on an adjacent conductor.

INSULATION - A non-conductive material used to separate conductors to prevent electrical short circuits.

INTEGRATED SERVICES DIGITAL NETWORK - ISDN. An architecture for the integration of such services as voice, data, and video onto the same cable for widespread distribution.

ISO - International Standards Organization. Based in Paris, this body develops open industry standards for the world. A key standard is the Open Systems Interconnection Network Model (OSI model) which forms a general definition for all LAN's.

JACK - A receptacle for a modular device. Mates with a plug.

JACKET - The outer protective sheath of a cable.

JITTER - The skewing of a transmitted pulse so as to cause its edge to become poorly defined and its width to be variable, causing data errors.

k - A short form for the metric "kilo" or 1000. Often appended to measurements of frequency (kHz), storage (kBytes), and bit rate (kbps).

LAY - The length of one conductor in a twisted pair in making one complete turn.

LCD - Liquid Crystal Display.

LINE - A term used loosely to describe a connection between two communicating devices.

LINE SPEED - The maximum rate of data transfer for a given line.

LOCAL DISTRIBUTION FRAME - LDF. Another name for an intermediate distribution frame.

M - Short form of the metric "mega" or 1,000,000. Used as a prefix for frequency (MHz), storage (MBytes), and line speed (Mbps).

m - Representation of the metric "milli" or 1/1000th.

MAIN DISTRIBUTION FRAME - MDF. The point at which outside service lines interface to inside service and then to IDF's.

MEDIUM - Material used for the transmission of signals.

MICRO - Prefix for one millionth. Used as a prefix for capacitance.

MICROFARAD - One millionth of a farad.

MJ - Modular jack. A term describing plug-in IDC connectors used in telephone and data communications. The connectors usually are configured with 4, 6, or 8 pins.

MMJ - Modified modular jack. Developed by Digital Equipment Corp. (DEC), it is an RJ-12 (6 pin) modular jack with the bottom locking tab offset to one side.

MP - A series of connectors designed for ease of use and flexibility. They are characterized by locking plastic tabs on the bottom and typically appear in three configurations: RJ-11 4 conductor), RJ-12 (6 conductor), and RJ-45 (8 conductor).

MULTI-DROP - A communications system connected to many points simultaneously. Usually only two devices can use the facility at any one time.

MUTUAL CAPACITANCE - The combined capacitance between twisted pairs in a cable.

NEAR-END CROSSTALK - The induction of transmitted signal onto the receive pair at the transmitting end of the medium.

NETWORK TOPOLOGY - The physical layout and interconnection of a network.

NODE - A connection point into a network. The node may perform several functions (i.e. file server, workstation, print server, bridge, etc.).

OCTOPUS - A cable adapter that transforms a 25-pair feeder into individual modular plugs.

OHMS - A measure of resistance. One ohm allows one ampere of current to flow across a one volt potential.

OPEN CIRCUIT - An incomplete circuit. A cable connected at one

end only is an example of an open circuit. The opposite of a short-circuit.

PAIR - Two wires, usually twisted around each other.

PAIRED CABLE - Cable in which all conductors are arranged in color-coded pairs usually twisted around each other and then surrounded by a sheath.

PATCH PANEL - A board with multiple jacks installed for the purpose of connecting devices with modular jacks and cables.

PDS - Premise distribution system.

PHYSICAL LAYER - The bottom layer of the OSI model, concerning physical interconnect hardware and electrical interface between devices.

PICOFARAD - One trillionth of a farad. A common unit used in measuring mutual capacitance in cable.

PLENUM CABLE - Cable insulated and sheathed in material fire-retardant enough to be used in a free-air plenum. This type of cable will not emit toxic fumes when burning. It is typically coated with Teflon.

POLYVINYL CHLORIDE - PVC. A common insulation material sheathing many types of paired and axial cable. Emits very toxic gases when burned so it may not be used in free-air plenums indoors. See also PLENUM CABLE.

POTS -Plain old telephone stuff. Slang term to describe unknown, older, generic telephone wire.

PREMISES DISTRIBUTION SYSTEM - A multifunction wiring system designed by AT&T for integration of voice, data, video, and graphics. It includes cables, adapters, electronic modules, wall jacks, and protective covers. It is scalable from a single floor to a campus environment.

PROPAGATION RATE - The speed at which electricity travels in a transmission medium. Expressed as a percentage of the speed of light (c).

PUNCH-DOWN BLOCK - A device used to terminate and cross-connect premises wiring.

RACEWAY - A metal or plastic trough used to guide and carry installed cabling.

RETURN LOSS - Return loss is a measurement of the ratio between transmitted signal strength and signal reflected back to the transmitting end. Like attenuation, excessive return loss reduces signal strength at the receive end. It also indicates a mismatched impedance at some point along the cable run.

RESISTANCE - The blockage or obstruction of current flow. A property of all conductors, measured in ohms.

RISER - The path between floors of a building carrying cables which interconnect the floors.

RS-232-C - A recommended standard developed by the EIA defining signal levels and pin assignments for serial data communications. Never established as a standard, it remains a general guideline to follow when interfacing DTE and DCE.

SAG - The downward curvature of a wire or cable due to its weight.

SDF - Sub distribution frame. Similar to an intermediate frame, but typically smaller and more localized. Provides cross-connection points.

SEGMENT - A cable run. Its maximum length is determined by the topology. A 10BASE2 segment may be up to 605 feet long. A 10BASET segment may be up to 328 feet long.

SERIAL TRANSMISSION - The sending of multiple data bits down a single line in a stream.

SHEATH - The outermost covering of a cable, usually an insulating material applied to protect the cable from environmental effects.

SHIELD - A conductive material installed between the insulated center conductor(s) and the sheath. Designed to provide increased immunity to interference caused by outside electrical noise. Usually constructed of metal foil or braided, stranded wire.

SHIELDED PAIR - A pair of wires, twisted together and covered with a conductive material to provide any potentially induced noise a quick path to ground.

SHORT CIRCUIT - A condition that exists when two conductors are connected ahead of where they normally should be in a circuit. This causes reduced resistance and sometimes other undesirable side effects.

SIGNAL GROUND - A common point of reference for all other signals in a communications interface.

SIGNAL TO NOISE RATIO - The ratio of received signal to existing system noise. In LAN applications it is the attenuation to NEXT ratio. Both are expressed in decibels.

SILVER SATIN - Flat, untwisted cable used typically as a telephone extension cord. It should never be used in a Local Area Network.

SPLIT PAIR - A situation that occurs when a twisted pair is misconnected so that it becomes 1/2 of two separate pairs. The noise immunity of the twists is lost and an impedance mismatch is created.

STAR TOPOLOGY - A physical layout in which each device is wired back to a central point.

STP - Shielded twisted pair. Cable constructed of pairs of insulated wire twisted around each other surrounded by shielding material made of foil or braid or both. The entire group of wires may have a common shield or each pair may be shielded individually with another shield around the entire group just under the sheath.

STRANDED CONDUCTOR - A wire or cable constructed of several small strands of conductor instead of one larger solid piece. This configuration provides for more flexibility in certain applications.

T CONNECTION - A connector fanning three directions and looking like a "T". Commonly used is a BNC T connector for 10BASE2 applications.

TAP - An electrical connection to a bus to enable access. A tap may be invasive (requiring a cable splice), or non-invasive (vampire tap).

TDR - Time Domain Reflectometer. A piece of test equipment used to measure metallic cable length and impedance.

TERMINATE - To connect a wire or wires to a device or a matching impedance connection.

THICKNET- Another term for IEEE 802.3 10BASE5 systems.

THIN ETHERNET - Normally describes a 10BASE2 system. Also called Cheapernet.

TIA - Telecommunications Industry Associates.

TOKEN RING - A logical ring topology which passes a token in one direction around the ring. A given device must possess the token to communicate with any other device. If it does not gain control of the token as it passes, it must wait until the token goes around the ring.

TOPOLOGY - The geometric form describing a network's logical and physical layout.

TRAFFIC - A measure of the activity on a network at a given time.

TRANSITION CONNECTOR - Defined by ISO as an under floor connector between the last patch panel and the office outlet permitted in the Basic and Channel Links. Nominal distances are 75 meters from the patch panel and 15 meters from the office outlet. The connector was designed to permit modular offices relocation inwhich office outlet wiring is retained with the office's modular segments.

TWINAXIAL CABLE - Cable constructed of two insulated center conductors surrounded by a braided shield. Widely used in midrange IBM systems.

TWISTED PAIR - Two insulated wires twisted around each other at regular intervals. May be shielded or unshielded. The number of twists per foot directly relates to the relative noise immunity of the pair.

UL - Underwriter's Laboratories. A testing body formed primarily to certify fire safety of electrical equipment dealing with voltages greater than 48 VAC or DC. UL has most recently assumed the responsibility for certification of data grade unshielded twisted pair media for conformance to EIA/TIA and NEMA specifications. The cable categories II through V from the EIA/TIA TSB 36 document serve as the basis for UL cable LEVELS 2 through 5. Cable certified by the UL to meet these standards will bear a label.

UNIVERSAL SERVICE ORDERING CODE - USOC. A wiring standard for telephone service to an individual phone. In a modular plug, the two center conductors are the primary pair, and supplementary pairs radiate out concentrically. For example, in an RJ-45 (eight pin) plug, pins 4,5 are the primary pair with pins 3,6 - 2,7 - 1,8 forming the supplementary pairs.

UTP - Unshielded Twisted Pair. Cable constructed of typically multiple twisted pairs of wires, unshielded in a PVC or plenum-rated sheath.

VAMPIRE TAP - A tap system for 10BASE5 systems which does not require cutting and splicing the cable. This system uses a sharp pin which pierces the insulator and contacts the center conductor of the thick 10BASE5 cable.

VOICE GRADE - A designation for a facility capable of carrying signals with a frequency range of 200 - 4000 Hertz.

VOLTAGE - The potential difference in energy between two points.

WAN - Wide area network. A network typically spanning a continent or the globe.

WIRING CLOSET - A central point for horizontal floor wiring to connect to vertical riser cable or to a larger cable running to an IDF.

X-ON/X-OFF - A basic form of information flow control for data communications, the receiving device would issue an X-OFF to the transmitter while it emptied its buffer to disk or performed another operation.

XC - Abbreviation for cross-connect.

Appendix A: Specifications

Performance and general specifications for the LANTEK PRO and LANTEK PRO XL.

Length	
Range	0-2000' (0-610 m)
Accuracy	±(3% + 3' + NVP uncertainty)
Resolution	0.1m (0.33')
Propagation Rate	0.5-0.99c ± 0.01
Delay	
Range	0-4000 ns
Accuracy	±(3% + 1 ns)
Resolution	1 ns
Average Impedance (Zo)	
Range	0-400Ω
Accuracy	±(3% + 1Ω)
Resolution	1Ω
Capacitance	
Range	0pF-100nF
Accuracy	±(2% + 20pF)
Resolution	1pF min.
DC Loop Resistance	
Range	0-400Ω
Accuracy	±(1% + 2Ω)
Resolution	0.1m (0.33')
Average (wideband) Noise	
Range	0-1VRMS
Bandwidth	50Hz - 30MHz
Resolution	10mV
Attenuation	
Swept Frequency Range	1MHz-102MHz
Full Range	70 dB
Frequency Steps	TIA TSB-67
Dynamic Range	50dB @ 1MHz to 30dB @ 100MHz (Log Curve)
Accuracy	±1.0 dB at channel or basic link limit
Resolution	0.1dB
Near End Crosstalk	
Swept Frequency Range	1 MHz-102 MHz
Full Range	70 dB
Frequency Steps	TIA TSB-67
Dynamic Range	70dB @ 1MHz to 45dB @ 100MHz (Log Curve)
Residual NEXT	55dB @ 100MHz
Accuracy	±1.6 dB at basic link limit
Resolution	0.1dB

Return Loss

Swept Frequency Range	1 MHz-102 MHz
Frequency Steps	TIA TSB-67
Dynamic Range	30dB
Accuracy	±1.6 dB
Resolution	0.1dB

TDR Plot (Impedance)

Range	0-400Ω
Accuracy	±(1% + 2Ω)
Resolution	0.1m (0.33')

General Specifications

Autotest Time	35 seconds
Display	160 x 160 graphical LCD
Memory	Stores 500 Autotest results*
Cable Types	38 standard + 10 custom + manufacturer's
ACR	Yes

Environmental

Operating Temperature Range	0-50°C
Temperature Coefficient	0.1 x spec/°C
Storage Temperature Range	(-20 to +70°C)
Humidity	5-90%, noncondensing

Mechanical

<u>Display Handset</u>	
Dimensions	10"x4.25"x2.5"
Weight	1.75 lb.
<u>Remote Handset</u>	
Dimensions	10"x4.25"x2.5"
Weight	1.6 lb.
<u>Charging Bay</u>	
Dimensions	3.15"x9.65"x3.75"
Weight	2.5 lb.
Input Power	110 volts ± 10% or 240 volts ± 10% 50 or 60 Hz
Output Power	9 VDC, 300 mA

Battery Management

Display Handset	8 hours typical
Remote Handset	14 hours typical
Recharging Time	3 hours or less

*If Fault Find graphs are saved in memory, the 500 test limit may be reduced.

Appendix B: Cable Configuration

The following tables list cable default test setting configurations based on industry and manufacturer recommendations. These settings are programmed into the LANTEK PRO / LANTEK PRO XL's Cable Type menu.

Menu Item →		1	2	3	4	5	6	7	8	9	10
		NVP Prop Rate	Imped. Nominal	Testing Range	Pin Usage (Shown in Pairs)	Loop Res. Max.	NEXT Limit at Max. Freq.	Atten. Limit at Max. Freq.	Length	Capaci-tance	ACR
Cable Group	Cable Type	(% C)	(Zo) Tol+/-	Start - Stop MHz - MHz		(Ohms)	(dB)	(dB)	Max. (ft/m)	Max. (pF/ft-pF/m)	Min. (dB)
Ethernet	10BASE-T	0.65	100 15%	1.0 - 10.0	3,6 1,2	20.0	26.0	10.5	328/100	20-66	10.5
	10BASE-2(RG-58)	0.66	50 10%	1.0 - 10.0	BNC	20.0	N/A	10.0	607/185	32-96	N/A
	10BASE-5	0.78	50 10%	1.0 - 10.0	BNC	20.0	N/A	30.0	1640/500	26-85	N/A
Token Ring	16MBonUTP	0.71	100 15%	1.0 - 16.0	3,6 4,5	20.0	38.0	12.3	328/100	17-56	17
	4MBonUTP	0.65	100 15%	1.0 - 4.0	3,6 4,5	20.0	32.0	16.0	328/100	20-66	17
	16MBonSTP	0.78	150 10%	1.0 - 16.0	3,6 4,5	17.0	32.0	15.0	328/100	9-30	13
	4MBonSTP	0.78	150 10%	1.0 - 4.0	3,6 4,5	17.0	23.0	8.5	328/100	9-30	13
	Enhanced STP-A	0.78	150 10%	1.0 - 100	3,6 4,5	17.0	27.1	24.0	328/100	9-30	10
Twisted Pair	TIA Cat 3	0.65	100 15%	1.0 - 16.0	3,6 1,2 4,5 7,8	20.0	21.0*	13.2*	30/94*	20-66	6
	TIA Cat 4	0.71	100 15%	1.0 - 20.0	3,6 1,2 4,5 7,8	20.0	33.7*	9.9*	30/94*	17-56	17
	TIA Cat 5	0.75	100 15%	1.0 - 100	3,6 1,2 4,5 7,8	20.0	29.3*	21.6*	30/94*	17/56	5
	ISO Class C	0.65	100 15%	1.0 - 16.0	3,6 1,2 4,5 7,8	40.0	19.0	14.5*	30/94*	17/56	5
	ISO Class D	0.75	100 15%	1.0 - 100	3,6 1,2 4,5 7,8	40.0	24.0	24.1*	30/94*	17/56	4
	TP-PMD	0.75	100 15%	1.0 - 100	1,2 7,8	20.0	29.3*	21.6*	30/94*	17/56	4
	TIA Cat 4 STP	0.71	100 15%	1.0 - 20.0	3,6 1,2 4,5 7,8	20.0	33.7*	9.9*	30/94*	17-56	17
	TIA Cat 5 STP	0.75	100 15%	1.0 - 100	3,6 1,2 4,5 7,8	20.0	29.3*	21.6*	30/94*	17/56	5
	ISO Class C STP	0.65	100 15%	1.0 - 16.0	3,6 1,2 4,5 7,8	40.0	19.0	14.5*	30/94*	17/56	5
	ISO Class D STP	0.75	100 15%	1.0 - 100	3,6 1,2 4,5 7,8	40.0	24.0	24.1*	30/94*	17/56	4
	TP-DDI STP	0.75	100 15%	1.0 - 100	1,2 7,8	20.0	24.0	24.1*	30/94*	17/56	4
Misc.	Localtalk	0.65	78 30%	1.0 - 2.0	3,6	20.0	N/A	10.0	328/100	20-66	N/A
	ISDN	0.65	100 15%	1.0 - 2.0	3,6 4,5	40.0	23.0	10.0	1066/325	20-66	13
	Single Pair	0.65	100 15%	1.0 - 2.0	4,5	20.0	N/A	10.0	328/100	20-66	N/A
	USOC	0.65	100 15%	1.0 - 2.0	3,6 4,5	40.0	23.0	13.3	2034/620	20-66	10
	IBM Coax	0.84	93 10%	1.0 - 10.0	BNC	20.0	N/A	35.0	2034/620	14-46	N/A
	TWINAX	0.66	100 10%	1.0 - 10.0	BNC	20.0	N/A	35.0	2034/620	16-52	N/A
	ARCNET (RG-62)	0.84	93 10%	1.0 - 10.0	BNC	20.0	N/A	35.0	2034/620	14-46	N/A
	CATV (RG-59)	0.66	75 10%	1.0 - 10.0	BNC	20.0	N/A	35.0	2034/620	21-69	N/A

* Defaults for "BASIC LINK" plus 4 meters of test leads. See next page for "CHANNEL LINK."

TIA/EIA and ISO CHANNEL LINK DEFAULTS

Menu Item =		1	2		3	4	5	6	7	8	9	10
Cable Group	Cable Type	NVP Prop Rate (% C)	Imped. Nominal (Zo)	Tol+/-	Testing Range Start - Stop MHz - MHz	Pin Usage (Shown in Pairs)	Loop Res. Max. (Ohms)	NEXT Limit at Max. Freq. (dB)	Attenuation Limit at Max. Freq. (dB)	Length Max. (ft/m)	Capacitance Max. (pF/ft-pF/m)	ACR Min. (dB)
Twisted Pair	TIA Cat 3	0.65	100	15%	1.0-16.0	3,6,1,2,4,5,7,8	20.0	19.3	14.9	328/100	20-66	6
	TIA Cat 4	0.71	100	15%	1.0-20.0	3,6,1,2,4,5,7,8	20.0	31.4	11.0	328/100	17-56	17
	TIA Cat 5	0.75	100	15%	1.0-100	3,6,1,2,4,5,7,8	20.0	27.1	24.0	328/100	17/56	5
	ISO Class C	0.65	100	15%	1.0-16.0	3,6,1,2,4,5,7,8	46.0	19.0	15.1	328/100	17/56	5
	ISO Class D	0.75	100	15%	1.0-100	3,6,1,2,4,5,7,8	46.0	24.0	25.0	328/100	17/56	4
	TP-PMD	0.75	100	15%	1.0-100	1,2,7,8	20.0	27.1	24.0	328/100	17/56	4
	TIA Cat 4 STP	0.71	100	15%	1.0-20.0	3,6,1,2,4,5,7,8	20.0	31.4	11.0	328/100	17-56	17
	TIA Cat 5 STP	0.75	100	15%	1.0-100	3,6,1,2,4,5,7,8	20.0	27.1	24.0	328/100	17/56	5
	ISO Class C STP	0.65	100	15%	1.0-16.0	3,6,1,2,4,5,7,8	46.0	19.0	15.1	328/100	17/56	5
	ISO Class D STP	0.75	100	15%	1.0-100	3,6,1,2,4,5,7,8	46.0	24.0	25.0	328/100	17/56	4
	TP-DDI STP	0.75	100	15%	1.0-100	1,2,7,8	46.0	24.0	25.0	328/100	17/56	4

Attenuation adjustment includes only 10 meters of patch cables. The 6 inch (15cm) test leads are negligible.

UNIQUE ISO TEST DEFAULTS

Menu Item =		1	2
		Delay (ns)	Return Loss (dB)
Twisted Pair	ISO Class C	900	15
	ISO Class C	900	10